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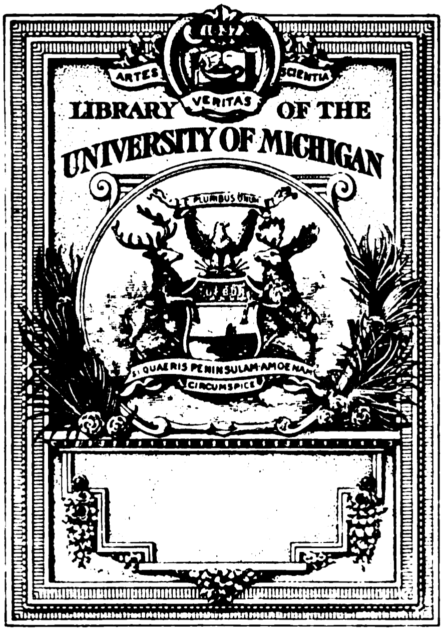
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LECTURES ON NERVOUS
AND MENTAL DISEASES

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BY

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Whosoever perseveres will succeed
For
Perseverance is the key stone of success

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PREFACE.

WHEN the writer began to lecture on Nervous Diseases nine years ago he was surprised to find so few homeopathic works upon this important subject. As the years went by he waited anxiously for the appearance of a work combining the anatomy, physiology, pathology, and the homeopathic therapeutics, but none made its appearance. Several works have come out partially covering the field, but none to which the student could turn and find what he desired stated in a brief and condensed form.

This fact led the writer to publish the lectures which follow as a text-book, covering the above points, and in addition showing in what diseases benefits from the application of electricity may be expected, and the best methods of applying it in the various diseases considered.

The basis of the work is the lectures delivered before the students of the Kansas City Homeopathic College for the past nine years. It includes the main facts which relate to mental and nervous diseases, gathered and condensed from the works of all schools, from journals, and every available source. In the preparation of this work the author has used freely from every available book and journal published on the subject of nervous and mental diseases and electro-therapeutics, so that the student not only gets the benefit of the writer's experience but also that of all the leading writers on these subjects. This information could only be found scattered through a greater number of books and journals than are within reach of students and practitioners in general.

It has been the aim and endeavor of the writer to simplify the various subjects so that students and practitioners will easily understand them.

In regard to the manner in which he has dealt with the various subjects, the words of Ruskin would apply where he says: " Certainly it is excellent discipline for an author to feel that he must say all that he has to say in the fewest possible words, or his reader is sure to skip them; and in the plainest possible words, or his reader will certainly misunderstand them. Generally, also, a downright fact may be told in a plain way; and we want downright facts at present more than anything else."

It is the aim of these lectures to describe and give the treatment for those diseases most likely to be met with in general practice.

The endeavor is made to have every general practitioner fully competent to treat all the more common affections of the mind and nervous system. Every general practitioner should know something of neurology, for there is no special line of study which the worker in general medicine or the family physician should apply himself to more assiduously than the nervous system, for it is a fact that all will admit, that, after all, *the nervous system represents our main capital.*

The diseases of the nervous system threaten to be the diseases of the future, as they are of the present day, in spite of any restraint that men can put upon themselves. Modern social life, especially in large cities, with its excitements, excesses, jealousies, struggles, disappointments, etc., is a great factor in causing nervous troubles.

In no department of medicine has greater advancements been made in recent years than in that relating to the diseases of the nervous system; in fact, nervous diseases constitute a modern study, and it is only within a very few years that the medical schools of the United States have even thought of having a chair especially devoted to this branch of medicine. While the greater body of physicians are prompt in detecting the first signs of deviation from the normal in the pulse-beat, in respiration, etc., the number is few—and these only with some special education—who will recognize the primary symptoms of organic or functional nervous disease. The writer ventures to indulge a hope that this work will supply this lack of information and will be an assistance to many general practitioners who have not had the advantage of special training in this field, and also that it will supply a need which he knows that many busy practitioners of medicine feel. Throughout this work, not only has the homeopathic treatment been fully given in each disease considered, but also all other adjunct methods of treatment that will assist in the palliation or cure of the diseases which have been described.

CHARLES SINCLAIRE ELLIOTT, M. D.

KANSAS CITY, *January*, 1897.

Dedication.

TO
THE MEMORY OF THE LATE
JOSHUA THORN, M. D.,
A MAN OF STERLING WORTH, AND ONE WHO WAS ALWAYS
READY TO HOLD OUT A HELPING HAND TO
EVERY BROTHER PRACTITIONER,
THIS WORK IS DEDICATED BY THE AUTHOR IN
GRATEFUL ACKNOWLEDGMENT OF HIS
TEACHING AND HIS FRIENDSHIP.

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LECTURES ON
NERVOUS AND MENTAL DISEASES.

THE CEREBRO-SPINAL NERVOUS SYSTEM.

GENERAL ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM.

Structure of Nervous Tissue.

AS to structure, nervous tissue is divided into gray or vesicular, and white or fibrous, each with distinct anatomical as well as physiological differences.

The first division, the gray, is composed of cells, and is the division in which nervous impressions and impulses originate; it is capable of generating the so-called nerve-force; it may act also as a conductor. It forms the essential constituent of all the ganglionic centers, both those separated in the ganglia and those aggregated in the cerebro-spinal axis.

It is found in the brain, spinal cord, the various ganglia, in some of the nerves of special sense, and in the gangliaform enlargements which are connected with the cerebro-spinal nerves. It is composed of nerve-corpuscles, imbedded either in a fine granular substance destitute of any nucleated sheath, as in the brain, or else contained in a hyaline capsule lined by a more or less continuous layer of nucleated endothelial cells, as in the ganglia. Each cell contains a nucleus, and sometimes nucleoli.

It has not been ascertained that the cell wall is limited by a distinct membrane. The cells vary in shape and size; they may be round, ovoid, conical, angular, caudated, or stellar. Most cells have one or more processes, and are distinguished by the number of processes, as unipolar, bipolar, or multipolar cells. Some of these processes are the beginning of nerve-fibers, and the cell from which this process springs is the trophic center for that nerve-fiber; and death to that cell means death and loss of function of that particular nerve-fiber.

The second division, the white or fibrous, acts as a conductor. Gowers (vol. i.) claims that fibers also can produce nerve-energy. In regard to this point he says: " We speak of cells producing and of fibers conducting what is termed nerve-energy. But fibers also can produce nerve-energy. The stimulation of a fiber is sufficient proof of this." The nerves generally, for example, receive direct impressions, the motor filaments conducting these to the muscles and the sensory filaments conveying the impressions to the centers. These fibers also conduct the force generated by the nerve-centers; but there are many fibers, such as those composing the white matter of the encephalon and the spinal cord, that are insensible to direct irritation, while they convey to the centers impressions conveyed to them by sensory nerves and conduct to the motor nerves the stimulus generated by nerve-cells.

Nerve-fibers are divided into two classes, namely, medullated and non-medullated nerve-fibers. The medullated nerve-fibers are so called because in addition to the axis-cylinder or conducting element they contain, inclosed in a tubular sheath, a soft substance called medulla. The nerve-fiber is surrounded by a delicate membrane, the *neurilemma*, sometimes called the sheath of Schwann. It exists in all the medullated nerve-fibers except those in the white portions of the encephalon and the spinal cord.

The medullary substance, or white matter of Schwann, fills the tube. It is composed of myelin, a fatty matter in the fluid state, and its functions are to insulate and protect the essential part of the nerve, the *axis-cylinder*. The medullated nerve-fibers present constrictions at regular intervals, called the

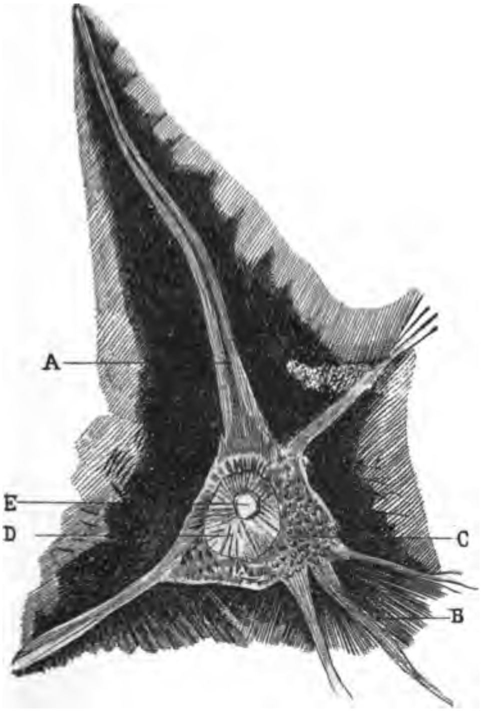

Fig. 1. Plate I.—A Diagrammatic Representation of a Multi-Polar Cell, Magnified about Eight Hundred Diameters.—A section of the cell is made through its greater axis, its interior texture being thus laid bare. *a*, represents a prolongation radiating from the mass of the nucleus itself, and the beginning of a nerve fiber; *b*, *b*, *b*, *b*, *b*, processes leading out from the cell connecting the cell with the other cells; *c*, spongy areolar substance, into which the structure of the cell itself is resolved; *d*, the nucleus; *e*, the nucleolus.

nodes of Ranvier. At these nodes the medullary substance is wanting and the neurilemma is in contact with the axis-cylinder.

This nodal segmentation keeps the almost liquid myelin uniformly distributed along the fiber and permits nutrient material to reach the axis-cylinder.

The axis-cylinder constitutes about one-half of the nerve-tube. In the natural state of the nerve it is transparent, and is therefore indistinguishable. Kölliker describes it as being distinguishable from the white substance by the fact that, though soft and flexible, it is not bluish and viscid, but firm and elastic, somewhat like coagulated albumin.

In the organs of special sense and in the final distribution of the sensory nerves the axis-cylinder breaks up into fibrillæ. The later researches show that the axis-cylinder is composed of fibrillæ held closely together by connective substance. Each one of the fibrillæ which go to make up the axis-cylinder as a whole is the prolonged process of a nerve-cell, which passes gradually into the axis-cylinder without any abrupt or visible change in structure. The axis-cylinder thus shares the life of the cell, and cannot maintain a separate existence.

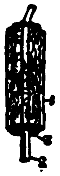

FIG. 2.—DIAGRAM OF THE STRUCTURE OF A MEDULLATED NERVE-FIBER. 1, represents the neurilemma or sheath of Schwann; 2, the medullary sheath; 3, the axis-cylinder.

Non-Medullated Nerve-Fibers.

These fibers appear to be simple prolongations of the axis-cylinder of the medullated fibers. They are found chiefly in the peripheral termination of the nerves and in the filaments of origin of the fibers from the nerve-cells.

Nerves.

Nerves are round or flattened cords formed of the nerve-fibers already described. They are connected at one end with the cerebro-spinal center, or with the ganglia, and are distributed at the other end to the various textures of the body.

Two Classes of Nerves.

1. Cerebro-spinal. 2. Sympathetic.

The cerebro-spinal are those which proceed from the cerebro-spinal axis, and consist of numerous nerve-fibers collected together and inclosed in a membranous sheath.

The cerebro-spinal nerves consist almost exclusively of the medullated nerve-fiber. The nerve-fibers do not coalesce, but pursue an uninterrupted course from center to periphery.

Nerves in their course subdivide into branches, and these frequently communicate with branches of a neighboring nerve. In the subdivision of a nerve the filaments of which it is composed are continued from the trunks into the branches, and at their junction with the branches of neighboring nerves the filaments pass to become intermixed with those of other nerves in their further progress; in no instance, however, have the separate nerve-fibers been shown to inosculate.

Nerve-Plexus.

Two or more nerves joined together constitute a plexus.

In the formation of a plexus the nerves divide, then join, and again subdivide in such a complex manner that the individual funiculi become interlaced most intricately, so that each branch leaving a plexus may contain filaments from each of the primary nervous trunks which form it.

Through this interchange of fibers the parts supplied by these nerves have more extended relations with the nervous centers; also by this means groups of muscles may be associated for combined action.

The sympathetic nerves are constructed in the same manner as the cerebro-spinal nerves, but consist mainly of non-medullated fibers collected into funiculi and inclosed in a sheath of connective tissue. In some cases, however, there is an admixture of the medullated fibers. They may be known by their color. Occasionally the gray and white cords run together in a single nerve without any intermixture, as in the branches of communication between the sympathetic ganglia and the spinal nerve, or in the communicating cord between the ganglia.

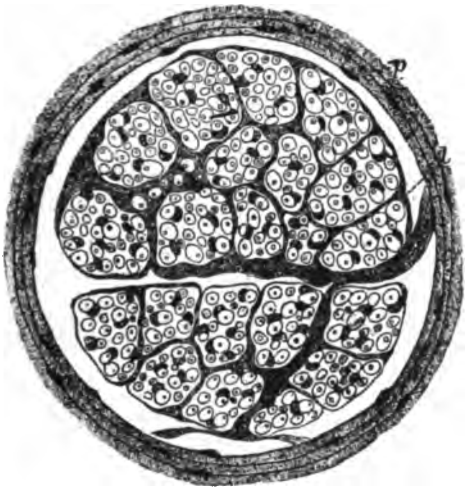

FIG. 3.—REPRESENTING A TRANSVERSE SECTION OF A COMPOUND NERVE-BUNDLE, SURROUNDED BY PERINEURIUM, MAGNIFIED ONE HUNDRED AND TWENTY DIAMETERS. The medullated fibers are seen as circles with a central dot, viz., medullary sheath and axis-cylinder in transverse section. They are imbedded in endoneurium containing numerous nuclei, which belong to the connective-tissue cells of the latter: *p*, perineurium, consisting of laminæ of fibrous connective-tissue, alternating with flattened nucleated connective-tissue cells; *l*, lymph-space between perineurium and surface of nerve-bundle.

Origin of Nerves.

A nerve may arise by one or more roots. If it is single, the whole nerve emerges from the nervous center by a single root; in other instances the nerve arises by two or more roots, which come off from different parts of the nerve-centers, sometimes widely apart from each other; and it often happens that when a nerve arises in this way by two roots the functions of these two roots are different; as, for example, the spinal nerves, each of which arises by two roots, the anterior of which is motor, the posterior sensory. The point where the nerve-root or roots emerge from the nervous center is named the *superficial* or *apparent* origin, but the fiber of which the nerve consists can be traced for a certain distance into the nervous center to some portion of the gray substance which constitutes the *deep* or *real* origin of the nerve.

There are two modes in which the fibers of the nerve-root originate and are connected with the nerve-cells. If the multipolar nerve-cells are examined, it will be found that one at least of their processes does not branch; this process is named the axial-cylinder process, and at first it has all the characteristics of an axis-cylinder. Soon, however, it acquires a medullary sheath and has been traced to be directly continuous with a nerve-fiber. Other processes of a multipolar cell divide and subdivide as they pass away from the cell, until at last they form branches of extreme tenuity and form an excessively minute network. These processes apparently consist of cell protoplasm, and are named protoplasm processes.

From the network which they form minute medullated nerve-fibers arise, so that it would appear that nerve-fibers arise, first, directly through the passage of the non-branched axis-cylinder process into a fiber, and, secondly, through the minute network formed by the branched protoplasm processes.

Termination of Nerves.

The termination of nerve-fibers varies according to the function of the nerve and the structure in which it terminates. The sensory nerves terminate either in minute primitive fibrillæ or a network of these, or else in special terminal organs; of these there are three principal varieties—namely, the end bulb of Krause, the tactile corpuscles of Wagner, and the

Pacinian corpuscles. The termination of a motor nerve varies according as to whether it ends in a voluntary or involuntary muscle. As a general rule, the cerebro-spinal nerves terminate in the voluntary muscles, while the sympathetic terminate in the involuntary muscles.

In the voluntary or striped muscles the nerves are composed mainly of medullated fibers. The nerve, after entering the sheath, breaks into fibers or bundles of fibers, which form plexuses and gradually divide until, as a rule, a single nerve-fiber enters a single muscular fiber. Sometimes, however, if the muscular fiber is long, more than one nerve-fiber enters it. Within the muscular fiber the nerve terminates in a special expansion called a motorial end-plate.

The nerve-fiber, on approaching the muscular fiber, loses the white substance of Schwann, its sheath becomes continuous with the sarcolemma of the muscle, and only the axis-cylinder enters the muscular fiber, when it immediately spreads out like the roots of a tree.

In the involuntary or unstriped muscles the nerves are composed mainly of the non-medullary fibers. Near their termination they divide into a number of branches which communicate and form an intimate plexus. From these plexuses minute branches are given off, which divide and break up into the ultimate fibrillæ of which the nerve is composed. These fibrillæ course between the involuntary-muscle cells and terminate on the surface of the cell, opposite the nucleus, in a minute swelling.

As to function, nerves are divided into two classes—namely:
1. Motor. 2. Sensory.

Motor or efferent nerves, also called centrifugal nerves, are those which carry impressions *from* the nerve-centers to the parts to which the nerves are distributed; these impressions either exciting muscular contraction or influencing the process of nutrition, growth, and secretion.

Sensory or afferent nerves, also called centripetal nerves, are those which carry *to* the nerve-centers impressions made upon the peripheral extremities of the nerves, and in this way the mind, through the medium of the brain, becomes conscious of external objects.

Electrical Irritability of Nerves and Muscles.

In the normal state nerve-fibers are stimulated by either the faradic or galvanic current; the stimulation of the motor nerves being shown by contraction in the muscles supplied by them, that of the sensory nerves by the sensation that is caused. This electric irritability is changed by disease, being lowered in proportion as the nutrition of the nerve-fibers is impaired; consequently it requires a stronger current of each kind to excite the nerves and cause contractions in the muscles which they supply.

By the end of the second week the faradic and galvanic irritability of the nerve will be entirely abolished. In the muscle the reaction to faradism runs the same course as in the nerve; that is, there is a gradual diminution and finally a loss of faradic excitability.* To galvanism, on the other hand, there is at first a progressive lowering of excitability, but by the end of the second week this is replaced by an increase of excitability, so that very weak currents, when the current is "made" or "broken" (that is, when the current is interrupted), may excite contraction of the muscles. This contraction is due *not* to a stimulation of the nerve, but to the stimulation of the protoplasm of the muscular fibers themselves;† this phenomenon is known as "reaction of degeneration," and occurs when the nerves are separated partially or completely from their motor (trophic) nerve-cells, and if no such separation exists, it indicates either an acute degenerative change in those nerve-cells or in the nerve-fibers; all involuntary movements are then impossible.

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* The increased irritability of the muscles to the galvanic current is owing, according to Gessler, to irritative processes within the sarcolemma.

† The rapid loss of faradic irritability of the muscle, as well as the change of the normal formula of contraction, is due to chemical change in the muscle. (Robinson.)

The term "reaction of degeneration" signifies that the muscle has lost its faradic irritability and that the nature of the response which the degenerate muscle makes to the continuous current differs from that exhibited by a healthy muscle. In health, when the galvanic current is applied to a muscle, the resulting contraction is quick, instantaneous; but when the reaction of degeneration is present, the contraction is slow and sluggish, thus differing markedly from the very rapid, lightning-like contraction given by a normal, healthy muscle.

In health the first contraction to occur on gradually increasing the strength of the current is at the *negative* pole when the circuit is closed, and a stronger current is required before closure-contraction occurs at the positive pole.*

But in diseased condition, the closure-contraction may occur at the positive pole as readily as at the negative, or more readily, and contractions when the circuit is broken occur far more readily than in the normal state. After four to six weeks this galvanic hyper-irritability begins to diminish, and the diminution is progressive until at last it becomes stationary; or after several weeks or months finally disappears.† Electric irritability will remain absent unless union of the divided nerves takes place. In that case the muscular irritability to both currents returns gradually, the slow, tardy contraction gives place to the quick, lightning-like ones, and the normal formula of contraction for nerves and muscles is re-established.

In testing nerves and muscles electrically, there are two

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* FORMULA OF CONTRACTION OF NERVES AND MUSCLES.—Robinson (Robinson, "International System of Electro-Therapeutics,") says that the irritability may vary in four different ways, namely: If the *negative* pole be applied to a nerve, and an electric current sent through it, a contraction will occur—the strongest obtainable from this current. It is called the *cathodal* closing contraction (Ca. Cl.). If the *positive* pole be applied to the same spot and close the current, the next strongest contraction, called the *anodal* closing contraction (An. Cl. C.), will be obtained. If this current be now broken or opened, there will be a still weaker response from the muscle, known as anodal *opening* contraction (An. O. C.). Finally, if the negative pole be again applied to this spot and the current opened, the weakest contraction of all will be obtained—cathodal *opening* contraction (Ca. O. C.).

† The decrease of the galvanic irritability, in the later stages, is due to the progressive increase in the muscular atrophy.

points that should be kept in mind—namely: 1. If the faradic current fails to produce muscular contraction, we know positively that the motor cells of the anterior horns of the spinal segments which control the paralyzed muscles are impaired, or that the nerve itself has been severed from its connection with the spinal cord, or is undergoing degeneration. 2. If the formula obtained by the galvanic current are normal, all questions regarding the existence of the degenerative changes in the nerve, or muscle-plates, can be excluded; but when the normal order is altered, degenerative changes in the nerve or motor cells of the spinal cord are present.

Mechanical Irritability of Nerves and Muscles, or the Reflexes.

Reflex action in voluntary muscles depends upon:

1. The sensory nerve which conveys the irritation to the multipolar cells in the anterior horns of the spinal cord.

2. Upon the multipolar cells which receive and perceive the irritation and originate a motor impulse.

3. Upon a motor nerve which conveys this motor impulse from the multipolar cells in the anterior horn of the muscle. This constitutes what is known as a " reflex arc."

If there is a diseased condition of the sensory nerve so that the irritation does not reach the multipolar cell in the anterior horn, there will be loss of reflex action in the voluntary muscle supplied by that nerve.

If there is disease in the multipolar cell of the anterior horn so that it cannot perceive the irritation or originate a motor impulse, there will be a loss of reflex action in the voluntary muscles supplied by nerves from this point, and, in addition to loss of reflex action, there will be almost complete loss of voluntary motion and there will be atrophy of the muscles.

If there is a diseased condition of the motor nerve connecting the anterior horn with the muscle, there will be loss of reflex action, complete paralysis of voluntary motion, and atrophy of muscles supplied by this nerve.

The reflex center is between the roots of the sensory and motor nerves.

Some of these reflex centers are of considerable vertical extent and much complexity.

Each spinal segment constitutes a reflex arc—*i. e.*, it consists of a sensory nerve to convey sensation, a cell which receives the impression and converts it into a motor impulse, and a motor nerve to convey the impulse.

The sensory impulse may not only excite a motor process, but may also pass up to the brain, and affect consciousness as a sensation.

The reflex center of the spinal cord is, to some extent, under the control of the brain center.

Two Forms of Reflex Action.

1. Superficial or " skin reflexes."
2. Deep or " tendon reflexes."

Superficial or " skin reflexes." Any of the sensitive parts of the body may be employed as a means of exciting reflex movements. By the means of these reflexes we are enabled to test the different spinal segments when we suspect organic disease of the cord. The skin of the soles of the feet, " plantar reflex "; of the inner aspect of the thigh, " cremaster reflex "; of the belly, " abdominal reflex "; of the region of the scapula and of the face is excited by a gentle stimulation, by a scratch, or by a prick from a sharp, pointed instrument. These spinal reflex actions vary in their excitability in different individuals, and are always more readily produced in the young than in the old.

Deep or " tendon reflexes." The ones now commonly employed are called, first, the *knee-jerk*, or *patella reflex;* second, the *peroneal reflex;* third, the *foot-clonus;* fourth, the *tendo-Achillis* reflex.

The first of these, the knee-jerk, is obtained when the patella tendon is tapped. The common method employed is to have the patient cross the leg over the knee, if then the patella tendon is struck the quadriceps contracts and jerks the leg forward. Perhaps a still better way is that employed by Gowers, viz., to allow it to hang over the forearm of the physician when his hand is placed upon the opposite knee of the patient; because in this way the jerk is often elicited in stout people when it otherwise fails. The space between the patella and the tibia is then struck with the percussion hammer, or the side of the physician's hand, upon the bare skin. Another method is to have them sit on the edge of a table.

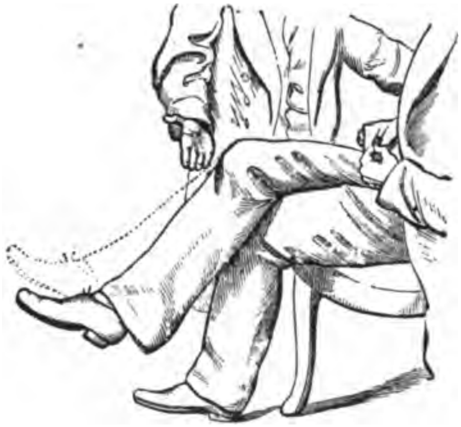

FIG. 4.—THE ORDINARY METHOD OF OBTAINING THE KNEE-JERK. The dotted lines indicate the movement which follows the blow on the patella tendon.

Peroneal reflex. This is produced by bending the foot inward and tapping the tendons of the peroneal muscles as they pass over the outer side of the ankle.

Foot-clonus. When the excitability of the cord is excessive, if the foot be firmly flexed and held so by the pressure of the hand against the sole, a series of rhythmical reflex movements of extension follows, which vary between six and ten per second.

Re-enforcement of a reflex. If the fingers are interlocked and the hands pulled strongly, grasping anything they can find with the hand, it assists in bringing out the knee-jerk more strongly. In doubtful or obscure cases it will render good service.

The knee-jerk cannot be obtained in locomotor ataxia or in infantile paralysis. We must remember that it is absent in a small per cent. of individuals even in health. A persistent foot-clonus never appears in health; it indicates a sclerosis (hardening) of the lateral columns of the cord. The " deep " or tendon reflexes are always increased in sclerosis of the lateral column. All reflex tests are abolished when the muscles are separated from their connection with the spinal cord.

" In the region of the cranial nerves the most important reflexes are those of the eye: (1) the conjunctival reflex, (2) the contraction of the iris on exposure of the eye to light, and its dilation on stimulation of the skin of the neck." (Gowers.)

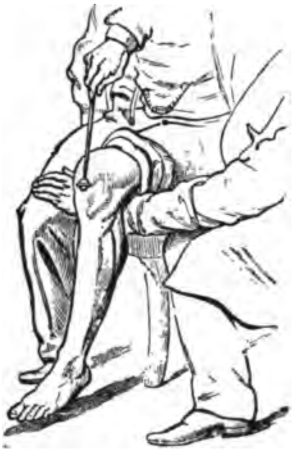

FIG. 5.—THE KNEE-JERK. Method of obtaining it when it is not produced in the ordinary way.

Pupillary reflex. Irritation of the "*cilio spinal center,*" which is located in the last two and the upper three spinal segments, causes the pupil to dilate; destruction of it causes the pupil to contract.

One of the principal pupillary reflexes that is of interest to the neurologist is known as the Argyll-Robertson pupil, from its discoverer, Dr. Robertson of Edinburgh.

This indicates a hardening or sclerosis of the spinal cord and occurs only when the disease has involved the cilio spinal center of the spinal cord.

This condition is indicated in the eye by preternaturally small pupils that do not respond to light, but will contract when efforts to accommodate the vision to near objects are demanded. Robertson noticed that the pupils of tabetic patients did not dilate in the shadow and contract in the light as do normal pupils, but would contract when the efforts to accommodate the vision to near objects were demanded. To test this point the patient should be placed facing a window or bright light and told to keep his eyes fixed upon some distant object (over twenty feet); then by shading the eyes with your hand you can see if the pupils change diameter. If you find an absence of reaction to light, then hold up one finger or a small object, as a lead pencil, within a foot of the patient's face and bid him look at it; at once the pupils contract.

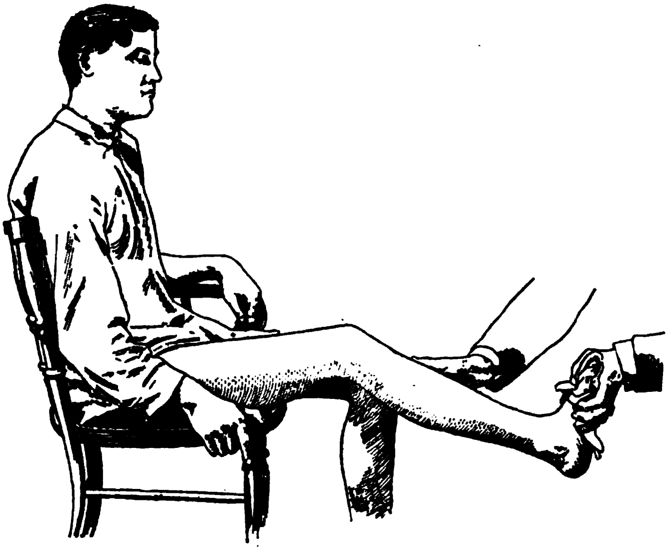

FIG. 6.—THE METHOD OF GETTING THE FOOT-CLONUS.

THE NERVOUS SYSTEM.

The nerve-fibers and cells are divided into two great systems, whose functions are entirely different.

1. The cerebro-spinal system, whose function is to control the voluntary muscles. This system is specially connected with the functions of animal life, and is often designated as the nerves of animal life.

2. The sympathetic system, whose function is to preside over the involuntary muscles, the secretions and excretions. This system is specially connected with functions relating to nutrition, operations which have their analogue in the vegetable kingdom, and is sometimes called the nerves of organic life.

The cerebro-spinal system consists of the brain, or encephalon, contained within the skull; the spinal cord, contained within the vertebral canal, and thirty-one pairs of spinal and twelve pairs of cranial nerves.

The Brain, or Encephalon.

The brain is that part of the cerebro-spinal system which is contained in the cavity of the skull. The average weight of the adult male brain is about 49 ounces, while that of the female is from 4 to 6 ounces less, or, as is sometimes given, 10 per cent. less. The brains of men who have distinguished themselves by their talent are often large. The brain of Cuvier, the celebrated naturalist, weighed 64.5 ounces, Spurzheim's 55.6, and Daniel Webster's 53.5. (Hammond.)*

Yet, notwithstanding these examples, the weight of the brain has not the great value which was formerly attached to it; that is, the size of the brain gives no estimate of the comparative intelligence of individuals, for there is no constant relation between the degree of intelligence and the weight of the brain. Three-fifths of the idiots have larger brains than men of ordi-

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* It is said that Daniel Webster had to increase the size of his hat every few years.

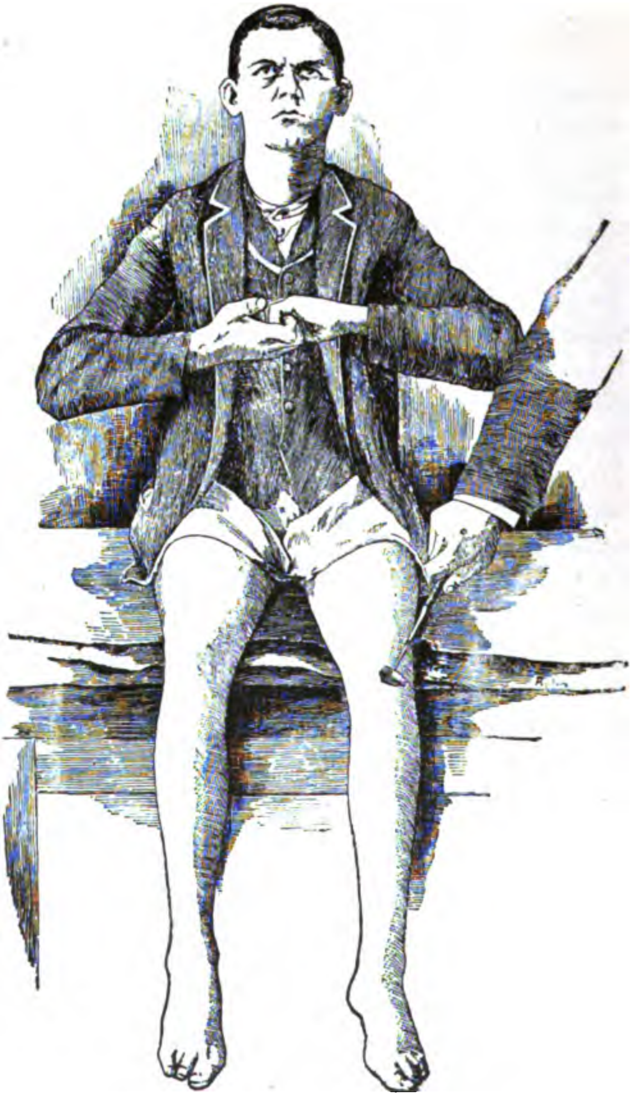

FIG. 7.—GETTING THE KNEE-JERK BY RE-ENFORCEMENT. (Dana.)

nary intelligence. Intelligence is something which cannot be weighed in the balance or carved with a scalpel.

Ireland,* in speaking of the relation between the degree of in-

* "Idiocy and Imbecility." (Ireland.)

telligence and the weight of the brain, says: "Some hold that it is in the fineness and degree of complexity of the convolutions, or in their symmetry on each hemisphere, that the power of thought depends; others say that we must look to the extent of the surface; still others, to the total amount of gray matter separated from the large mass of white matter of the brain. . . The fact of the matter is, that in considering the mental power in relation to the material organs of thought,

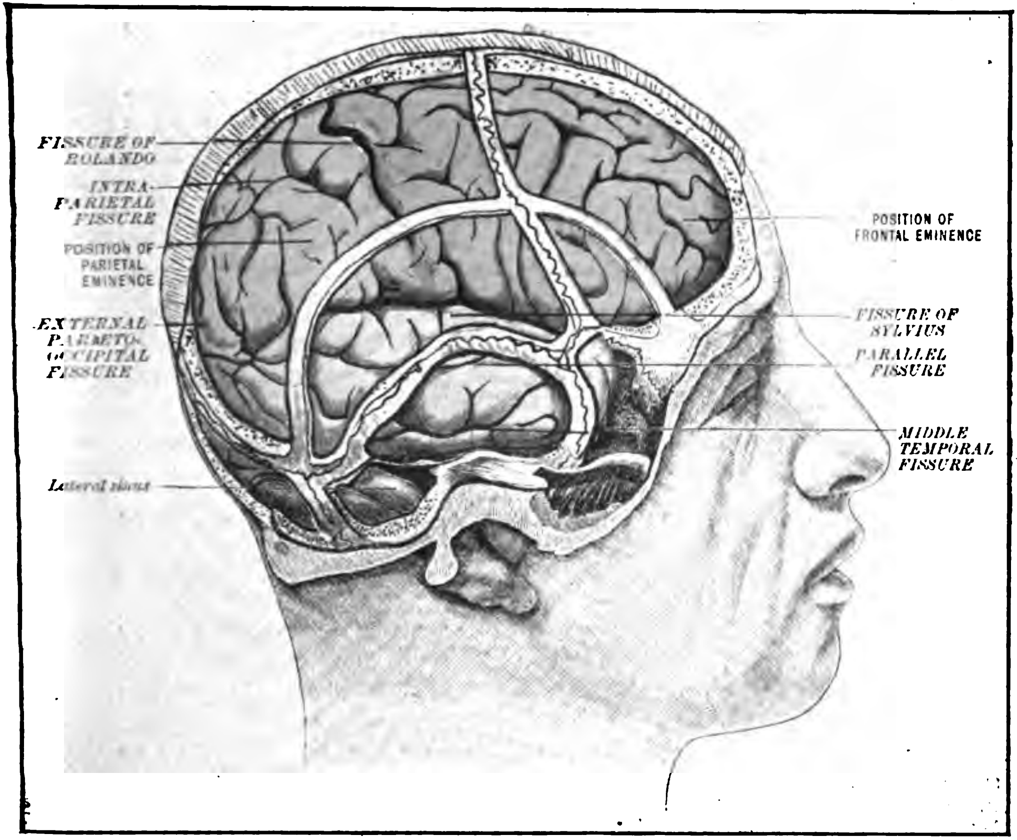

FIG. 8.—DRAWING OF A CAST OF THE HEAD OF AN ADULT MALE. (After Morris.) Prepared by Professor Cunningham.

we have to keep in view not only the size of the brain, but the complexity of the convolutions, and their connections with one another, the commissures which join the two hemispheres, the amount of gray matter, the general sensibility of the nervous system, the nature of the blood, the temperament, and the general vigor of the constitution, for all these go to make up the sum total, and a deficiency in any one of them may cause a harmony to jar." Therefore, we see that the brain is but one factor; the quality of the blood which circulates through every part of it, the quickness of the circulation, and the assimilative power existing between the nourishing fluid and the nervous matter are all factors in the production of thought.

In early infancy the weight of the brain in the two sexes is nearly equal; at birth the ratio being, male, 11 ounces; female, 10 ounces. According to Meckel, the weight of the brain in the newborn child is 300 grams (12½ ounces), but doubles its weight within the first five months.

The most rapid period of growth of the brain is from infancy up to the age of seven years. During that period the brain is developed far in excess of the other organs of the body; hence the greater preponderance of brain affections, fevers, and spasms during infancy. After the seventh year, up to the fortieth, the brain grows slowly; at that period it attains its full development; after that age it decreases in weight about one ounce for every period of ten years. When the brain is markedly below the average weight, mental weakness is a necessary concomitant. Gratiolet fixes the lowest weight of the brain in a person of ordinary intelligence at about 31¾ ounces. When the weight is below this, the individual is necessarily an idiot.

A case is recorded of a boy of twelve years of age whose brain weighed but 8½ ounces; the convolutions were strongly marked, though few in number and narrow. Gore has reported a case of a woman, forty-two years of age, whose intellect was infantine, who could scarcely say a few words, whose gait was unsteady, and whose chief occupation was carrying and nursing a doll; after death, the weight of the brain was found to be but

10 ounces and 5 grains. In three individuals of very feeble intelligence, whose ages were sixteen, forty, and fifty years respectively, Tiedemann found the weights of their brains to be 19¾, 25¾, and 22½ ounces respectively. Hammond reports the case of a woman, twenty-two years of age, who was unable to talk, but making known her more inferior wants by a few inarticulate sounds; the cranium had a circumference of only 14 inches at its largest measurement,* and the brain was found to weigh but 23½ ounces. The thickness of the gray matter at no part of the surface exceeded $\frac{1}{25}$ of an inch, and generally was below this point, whereas in the brain of a person of ordinary intelligence it is often more than twice this depth. On the other hand, there are instances of idiocy in which the weight of the brain is little, if any, below the average; and again, some remarkably large brains have been found among imbeciles.

Tuke describes the brain of an epileptic idiot that weighed 60 ounces, within 4 ounces of the weight of the brain of Cuvier. He attributes this great weight to the great increase which he found in the neuroglia and a molecular deposit observed in the vessels. There is one case reported from the West Riding Lunatic Asylum, Yorkshire, England, 1876, of a congenital imbecile, aged thirty years, height 5 feet 8 inches, whose brain weighed 70½ ounces. Its consistence was normal, and there was no evidence of sclerosis. The cerebrum alone weighed 63 ounces, and the cerebellum, pons, and medulla 7½ ounces. The circumference of the head was 24½ inches. This is heavier than the heaviest normal brain on record. In idiots the cerebellum is not diminished in size in proportion to that of the cerebrum.

An entire absence of the brain at birth (acephalous), and in some instances of the spinal cord in part, has been recorded. The cerebrum, cerebellum, pons Varolii, and medulla oblongata may be absent and yet the cranial nerves be perfectly developed. The cerebrum, cerebellum, and pons may be absent, but if the medulla is present, the child can breathe and even be made to cry. It generally dies, however, during the first week, with convulsions.

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* In no adult, not an idiot, is the cranium less than 17 inches in circumference. The true typical idiot's head measures on an average only about 13 inches in circumference, while that of an ordinarily developed head will measure from 20 to 24 inches, or even more.

Atrophy of the brain may be general or partial; it may be congenital, or acquired some time after birth. In general atrophy the whole brain may be so small as to constitute a condition known as microcephalous; in this form there is incomplete development, and it is usually congenital.

Tuke* reports a case where the brain weighed only 7 ounces, yet a minute examination of it showed that nearly all the convolutions were present, though very small in size.

Partial atrophy of the brain may be congenital or acquired. Cases of atrophy of one side of the brain, usually the left, with coexisting atrophy of the limbs of the opposite side of the body, are not infrequent. An inflammation of the brain, meninges, or skull, occurring before birth or coming on afterward, may cause this disease.

According to Dr. Schroeder Vanderkolk, there may be atrophy of one lateral half of the brain with very little, if any, impairment of the mental faculties. He says: " There is no reason why the remaining hemisphere should not be able to act without impediment in the exercise of those functions which are necessary to our mental powers, just as one eye sees as sharply though the other be lost." Nevertheless, atrophy of greater or less extent of one hemisphere is usually accompanied by a more or less degree of idiocy. It is rare to meet perfectly unimpaired intellectual powers with this lesion.

Certain convolutions of the brain may be arrested in the development and a cyst filled with serum, springing from the meninges, occupy the space thus left vacant. Cases are on record where there was absence of, or atrophy of the cerebellum; also of an optic thalamus, and a corpus striatum.

Hypertrophy of the brain is a comparatively rare disease, and is often erroneously confounded with chronic hydrocephalous (for differential diagnoses see " Chronic Hydrocephalous ").

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* " Dictionary of Psychological Medicine."

The brain consists of: (1) the cerebrum; (2) the cerebellum; (3) the pons Varolii; (4) the medulla oblongata.

The Cerebrum.

The cerebrum in man constitutes the largest portion of the encephalon. Its upper surface is of an ovoidal form, broader behind than in front, convex in its general outline. It is divided into lateral halves by the great longitudinal fissure, which extends throughout the entire length of the cerebrum in the middle line, reaching down to the base of the brain in front and behind, but interrupted in the middle by a broad transverse commissure of white matter, the *corpus callosum*, which connects the two hemispheres together. The surface of the cerebral hemispheres is marked by ridges, termed "convolutions," or "gyri," and depressions or fissures, commonly designated as "sulci." The sulci between the convolutions vary in depth in different parts, the average being about an inch. The gray matter, which is external and follows the convolutions, is $\frac{1}{12}$ to $\frac{1}{8}$ of an inch in thickness. By this arrangement the convolutions are adapted to increase the amount of gray matter without occupying much additional space, while they also afford a greater extent of surface for the termination of the white fibers of the gray matter.

The gray matter of the cerebrum is placed chiefly upon the exterior, but is also found in the interior of the brain; the corpora striata, optic thalami, and the corpora quadrigemina are instances of this. The gray matter upon the exterior of the brain is termed the *cortex*, and is composed of cells, supported by a fine network of connective tissue, called *neuroglia*. These cells are arranged in superimposed strata or layers.

In the majority of the convolutions of the cerebrum the cortex may be subdivided into five strata. Some neurologists claim that there are six or even seven layers. The cells of each stratum are similar in size and in shape, but the size and shape of the cells vary in the different layers. There is a marked difference in the appearance of the cells in the most superficial and the deepest portions of the gray substance.

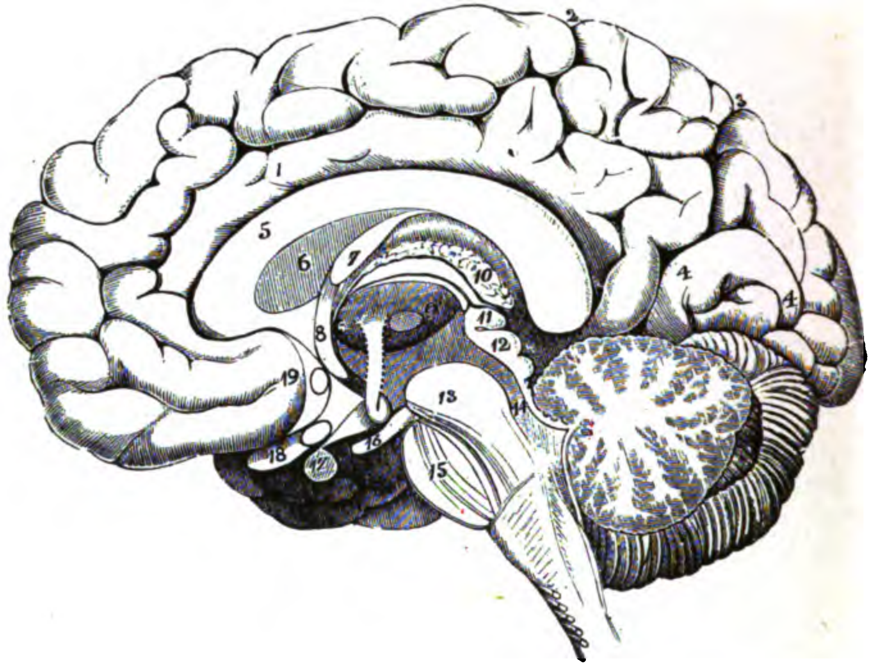

FIG. 9.—A VERTICAL MEDIAN SECTION THROUGH THE BRAIN, SHOWING THE PARTS IN THE MIDDLE LINE. 1. Convolution of the corpus callosum. Above it is the calloso-marginal fissure running out at 2, to join the fissure of Rolando. 3. The parieto-occipital fissure. 4, 4, point to the calcarine fissure, which is just above the numbers. Between 2 and 3 are the convolutions of the quadrate lobe. Between 3 and 4 is the cuneate lobe. 5. The corpus callosum. 6. The septum lucidum. 7. The fornix. 8. Anterior crus of the fornix, descending to the base of the brain, and turning on itself to form the corpus albicans. Its course to the optic thalamus is indicated by a dotted line. 9. The optic thalamus. Behind the anterior crus of the fornix a shaded part indicates the foramen of Monro; in front of the number an oval mark shows the position of the gray matter continuous with the middle commissure. 10. The velum interpositum. 11. The pineal gland. 12. The corpora quadrigemina. 13. The crus cerebri. 14. The valve of Vieussens (above the number). 15. The pons varolii. 16. The third nerve. 17. The pituitary body. 18. The optic nerve. 19. Points to the anterior commissure, indicated by an oval mark behind the number.

The first or most superficial layer is thin and contains much neuroglia and a few small star-shaped cells. The second layer contains a large number of pyramidal cells, closely packed together. The third layer is the thickest of all, and contains large pyramidal cells, which become larger in the deepest portion.

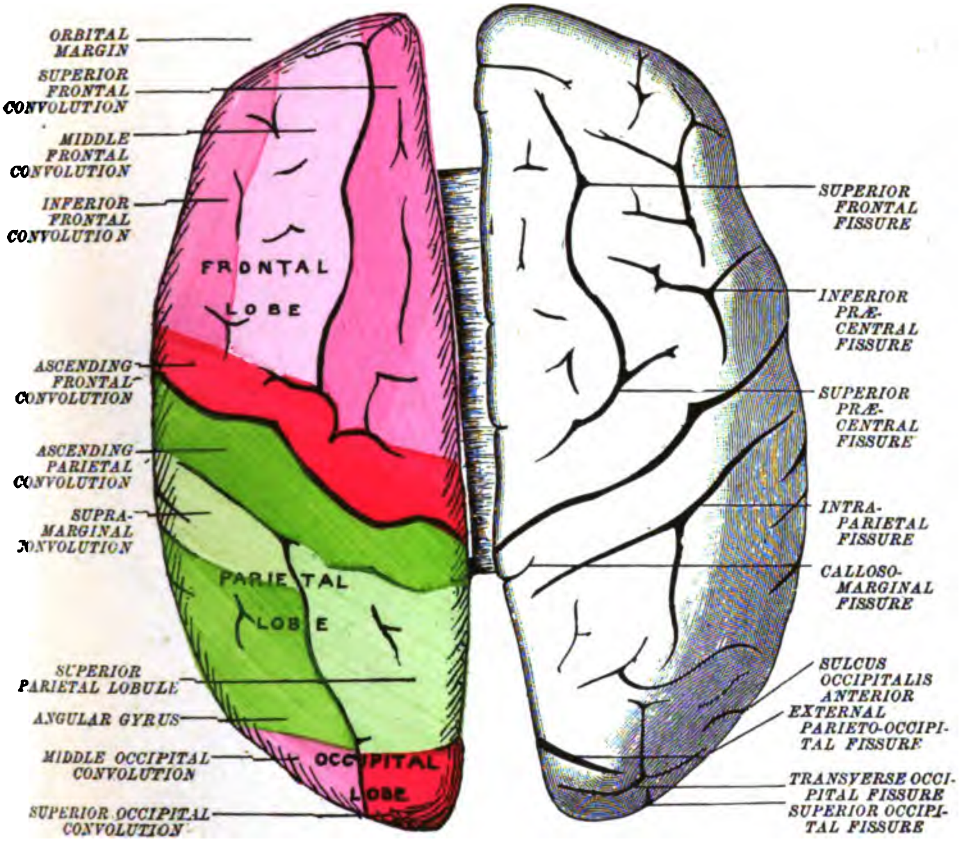
ORBITAL MARGIN
SUPERIOR FRONTAL CONVOLUTION
MIDDLE FRONTAL CONVOLUTION
INFERIOR FRONTAL CONVOLUTION
FRONTAL LOBE
ASCENDING FRONTAL CONVOLUTION
ASCENDING PARIETAL CONVOLUTION
SUPRA-MARGINAL CONVOLUTION
PARIETAL LOBE
SUPERIOR PARIETAL LOBULE
ANGULAR GYRUS
MIDDLE OCCIPITAL CONVOLUTION
OCCIPITAL LOBE
SUPERIOR OCCIPITAL CONVOLUTION
SUPERIOR FRONTAL FISSURE
INFERIOR PRÆ-CENTRAL FISSURE
SUPERIOR PRÆ-CENTRAL FISSURE
INTRA-PARIETAL FISSURE
CALLOSO-MARGINAL FISSURE
SULCUS OCCIPITALIS ANTERIOR
EXTERNAL PARIETO-OCCIPITAL FISSURE
TRANSVERSE OCCIPITAL FISSURE
SUPERIOR OCCIPITAL FISSURE

FIG. 10.—THE FISSURES AND CONVOLUTIONS OF THE CEREBRUM, VIEWED FROM ABOVE. (After Morris.]

The fourth layer contains a large number of small cells, closely packed together, irregular in form and with branching prolongations. The fifth layer presents spindle-shaped cells with branching poles; this is the layer just above the white substance. In the different layers each cell gives off several processes. Some of these processes are for the purpose of connecting cells of the same layer together, others to connect the cells with the layer above or below; still others pass to the white substance in the form of axis-cylinders, thereby connecting the cells with the nerve-fibers. Some of these nerve-cells are for generating nerve-force; others serve as receptacles for nervous impressions.

Luys advances the theory that the sub-meningeal stratum, which is characterized by the presence of cells of small size, is to be considered as the area of the diffusion of general and special sensation, and that the deeper strata, characterized by the presence of large cells, are the centers for the development and emission of motor impulses.

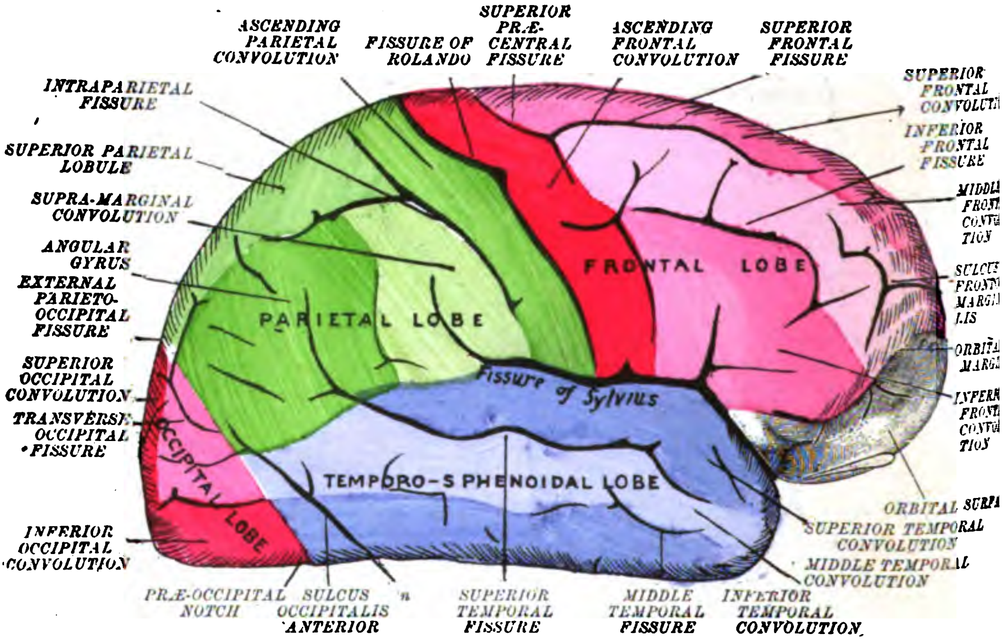
ASCENDING PARIETAL CONVOLUTION
FISSURE OF ROLANDO
SUPERIOR PRÆ-CENTRAL FISSURE
ASCENDING FRONTAL CONVOLUTION
SUPERIOR FRONTAL FISSURE
SUPERIOR FRONTAL CONVOLUTI
INFERIOR FRONTAL FISSURE
MIDDL FRON CONVO TION
SULCU FRONT MARGI LIS
ORBITA MARG
INFERI FRON CONVO TION
ORBITAL SURFA
SUPERIOR TEMPORAL CONVOLUTION
MIDDLE TEMPORAL CONVOLUTION
INTRAPARIETAL FISSURE
SUPERIOR PARIETAL LOBULE
SUPRA-MARGINAL CONVOLUTION
ANGULAR GYRUS
EXTERNAL PARIETO-OCCIPITAL FISSURE
SUPERIOR OCCIPITAL CONVOLUTION
TRANSVERSE OCCIPITAL FISSURE
INFERIOR OCCIPITAL CONVOLUTION
PARIETAL LOBE
FRONTAL LOBE
Fissure of Sylvius
TEMPORO-SPHENOIDAL LOBE
OCCIPITAL LOBE
PRÆ-OCCIPITAL NOTCH
SULCUS OCCIPITALIS ANTERIOR
SUPERIOR TEMPORAL FISSURE
MIDDLE TEMPORAL FISSURE
INFERIOR TEMPORAL CONVOLUTION

FIG. 11.—LATERAL VIEW OF THE FISSURES AND CONVOLUTIONS OF THE CEREBRUM. (After Morris.)

In those regions of the cortex which contain the motor centers, very large cells, called *giant cells*, are found clustered

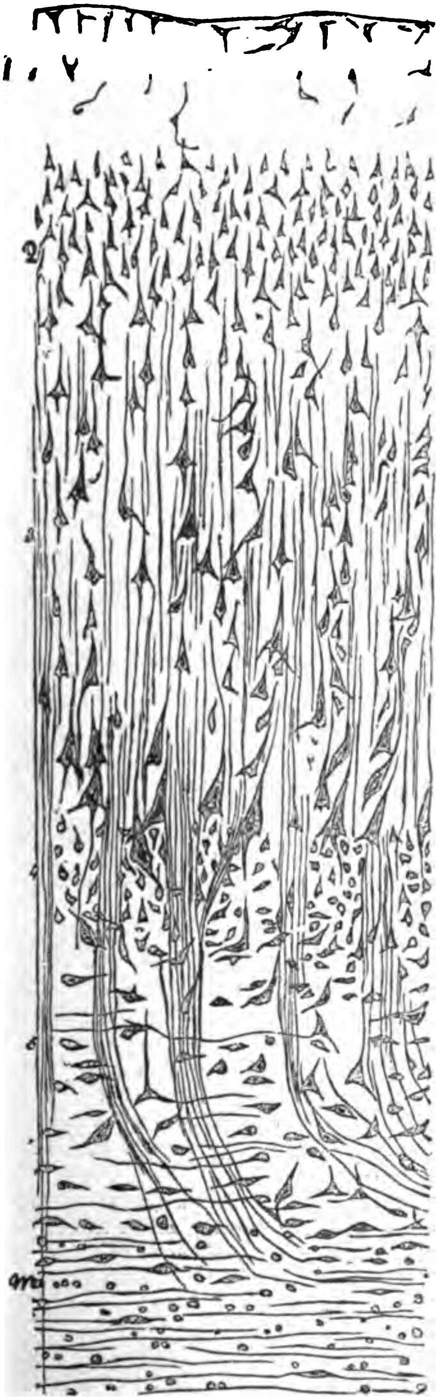

FIG. 12.—VERTICAL SECTION THROUGH THE GRAY MATTER OF THE CEREBRAL CORTEX, SHOWING THE SHAPE AND SIZE OF THE CELLS IN THE DIFFERENT LAYERS OF GRAY MATTER. (Meynert.) Magnified one hundred times. 1, layer of the small dispersed cortical elements; 2, layer of small pyramidal cells; 3, layer of large pyramidal cells; 4, layer of small, irregular cells; 5, layer of spindle-shaped cells; M, medullary substance.

together. Large cells with few prolongations are found in the posterior part of occipital lobes, connected by communicating poles. The cerebral cortex is now regarded as the exclusive seat of mental activity.*

Fissures of the Brain.

There are five principal fissures and several minor ones. The more important fissures are:

1. The *longitudinal* fissure, which separates the right and left lobes of the cerebrum.

2. The *transverse* fissure, which separates the cerebrum from the cerebellum.

3. The fissure of *Sylvius*, which begins at the base of the brain, at the anterior perforated space, and passes outward to the external surface of the hemisphere. It divides into two branches, one, the ascending limb, passes in front of the island of Reil, and upward between the frontal convolutions; the other branch, the horizontal, passes backward behind the island of Reil, and separates the temporo-sphenoidal lobes from the frontal and parietal lobes.

4. The fissure of *Rolando* is situated about the middle of the outer surface of the hemisphere. It separates the ascending frontal and ascending parietal convolutions.

5. The *parieto-occipital* fissure separates the parietal and

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* Ranney gives the following propositions as essential proofs of the psychical functions of the cerebral cortex :

"1. In the animal series the cerebrum seems to be developed in excess of other parts of the brain in proportion as the individuals of any class approach the standard of man in mental powers. We judge of this by its weight, and also by the number of 'convolutions' or 'gyri.' The latter serve to increase the amount of gray matter in proportion to the superficial area of the brain.

"2. In cases where the cerebrum is extremely small from birth, there appears to be a corresponding diminution in the higher mental faculties, or idiocy exists.

"3. Some form of mental disturbance almost always follows injuries, compressions, and diseases of the cerebrum—as evidenced by insensibility, somnolence, abnormal excitement, or some marked eccentricities of demeanor.

"4. Experimental physiology has shown that a removal of the cerebral hemispheres in the bird (in which animal it is easily accomplished) produces a stupor resembling sleep, in which all *voluntary acts cease.*"

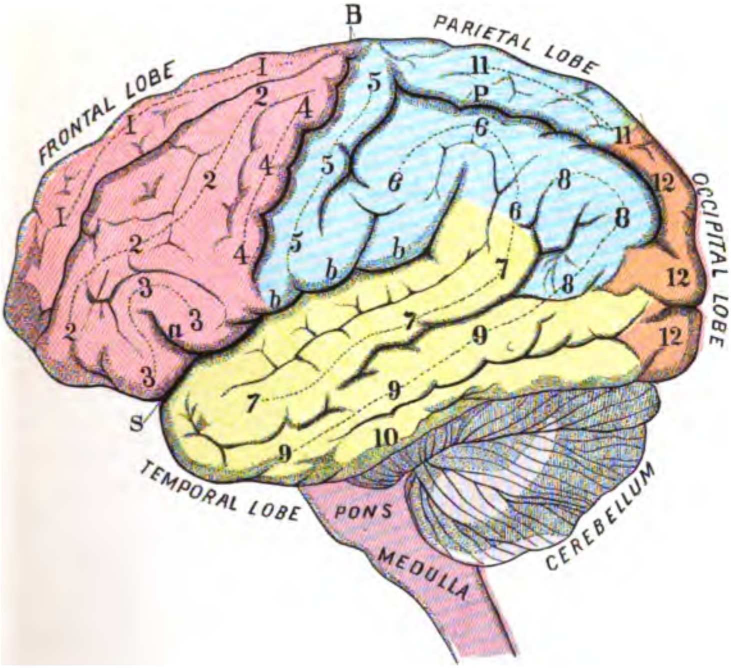

FIG. 13, PLATE II.—A DIAGRAM SHOWING THE LOBES AND FISSURES OF THE CEREBRUM, AND THE CONVOLUTIONS OF EACH LOBE—(Dalton). *S.* Fissures of Sylvius, with its two branches, *a*, and *b*, *b*, *b*. *R.* Fissure of Rolando. *P.* Parieto-occipital fissure. 1, 1, 1. The first, or superior frontal convolution. 2, 2, 2, 2. The second, or middle frontal convolution. 3, 3, 3. The third frontal convolution, curving around the ascending limb of the fissure of Sylvius (center of speech movements). 4, 4, 4. Ascending frontal convolution. 5, 5, 5. Ascending parietal convolution. 6, 6, 6. Supra-Sylvian convolution which is continuous with 7, 7, 7, the first or superior temporal convolution. 8, 8, 8. The angular convolution (or gyrus), which becomes continuous with 9, 9, 9, the middle temporal convolution. 10. The third, or inferior temporal convolution. 11, 11. The superior parietal convolution. 12, 12, 12. The superior, middle, and inferior occipital convolutions, called also the first, second, and third (the centers of vision).

occipital lobes. It is not always easily distinguished from the surrounding sulci. The minor fissures are nothing more or less than large sulci, a few of which are the hippocampal, the olfactory, the collateral, the calloso-marginal, and the calcarine fissures; but the first five are the ones which we depend upon to guide us as landmarks.

There are four lobes and four lobules upon the exterior surface of the cerebrum.

The Lobes of the Cerebrum.

The lobes of the cerebrum are named from the bones with which they are in relation, and are as follows: (1) The frontal lobe; (2) the parietal lobe; (3) the temporo-sphenoidal lobe; (4) the occipital lobe.

1. The frontal lobe comprises nearly the anterior half of the cerebral hemisphere. It includes all in front of the fissure of Rolando. The frontal lobe is divided into four convolutions or gyri: (*a*) The ascending frontal convolution is that portion of the frontal lobe which lies anterior to the fissure of Rolando, being separated from the ascending parietal convolution by that fissure. (*b*) The first or superior frontal convolution is that division of the frontal lobe which passes horizontally across the upper surface. (*c*) The second or middle frontal convolution lies beneath and passes parallel to the superior. (*d*) The third or inferior frontal convolution lies below and parallel to the middle convolution, and embraces the ascending limb of the fissure of Sylvius. The third is sometimes called Broca's convolution.

2. The parietal lobe is bounded in front by the fissure of Rolando, behind by the parieto-occipital fissure, and below by the horizontal limb of the fissure of Sylvius. It has four convolutions, called (*a*) the ascending; (*b*) the supramarginal; (*c*) the parietal, also termed the superior parietal convolution; (*d*) the angular gyrus.

The ascending parietal convolution is that part which lies back of the fissure of Rolando. The supramarginal lies back of the ascending parietal convolution and above the horizontal limb of the fissure of Sylvius; it extends backward to the posterior extremity of the fissure of Sylvius, around which it curves, and is continuous with the first temporal convolution. The superior parietal convolution lies along the margin of the great longitudinal fissure, being continuous in front with the ascending parietal convolution and limited behind by the parieto-occipital fissure. The angular gyrus is a small convolution lying back of and below the supramarginal, and is continuous with the second temporal convolution.

3. The temporo-sphenoidal lobe is that portion of the hemisphere which is lodged in the middle fossa of the base of the skull. In front and above it is limited by the fissure of Sylvius. It presents three well-marked convolutions which run in an antero-posterior direction. They are named: (*a*) the superior temporo-sphenoidal convolution, which lies below the fissure of Sylvius; (*b*) the middle temporo-sphenoidal convolution; (*c*) the inferior temporo-sphenoidal convolution. These convolutions are often designated as the first, second, and third temporo-sphenoidal convolutions.

4. The occipital lobe is situated at the posterior extremity of the brain, is separated above from the parietal lobe by the parieto-occipital fissure, and is divided into three convolutions, named from their position, from above downward, the first, second, and third occipital convolutions. These convolutions are not clearly defined.

The Lobules.

1. The lobulus centralis, or island of Reil, is situated at the base of the brain, at the beginning of the fissure of Sylvius, and can only be seen by lifting up the lower part of the ascending frontal and ascending parietal convolutions. It is a triangular-shaped eminence, consisting of a cluster of about five or six convolutions, the gyri operti, so called from being covered in by the sides of the fissure.

This is one of the most important of the lobules, on account of its containing the center for the movements necessary to articulate speech, as discovered by Broca; hence it is sometimes called Broca's speech center.

In some cases of idiocy the convolutions of the island of Reil are found to be imperfectly developed or entirely absent.

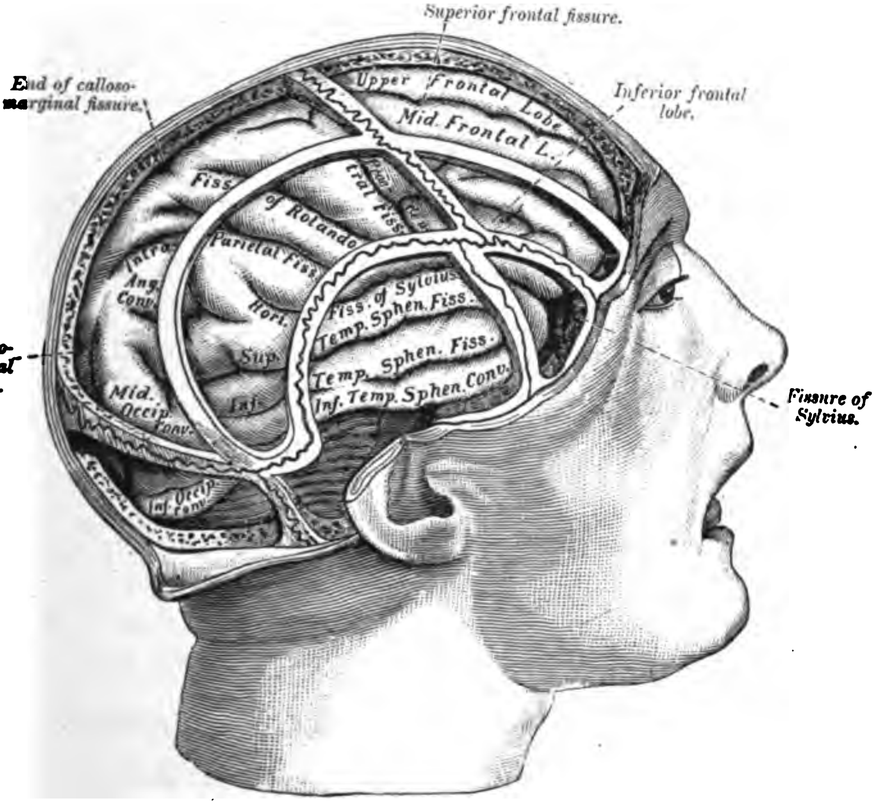

FIG. 14.—DRAWING TO ILLUSTRATE CRANIO-CEREBRAL TOPOGRAPHY. (Gray, after Macalister.)

2. The para-central lobule is located at the upper extremity of the fissure of Rolando, on the internal surface of the cerebrum, in front of the lobulus cuneus. It is the fused upper ends of the ascending frontal and ascending parietal convolutions.

3. The lobulus quadratus lies between the calloso-marginal fissure in front and the parieto-occipital fissure behind, and is located between the para-central lobule and lobulus cuneus.

4. The lobulus cuneus is a triangular-shaped convolution lying posteriorly to the lobulus quadratus.

Functions of the Cerebrum.

The brain has complex functions; it may be deranged in the whole of these functions, in one only, or in any number of them.

We will start with the proposition that no intelligence can exist without brain-substance; that the destruction of brain-substance impairs intellectual power; and that the normal use of the brain implies a degeneration of its substance and a constant process of regeneration. The cortical gray substance of the cerebral hemispheres is capable of generating motor impulses, of the kind known as voluntary, and of receiving sensory impulses. The existence of the mind and the possibility of normal operations of the intelligence depend upon the existence of the gray matter of the cerebral cortex and its normal physiological conditions and relations. Loss of cerebral substance from repeated hemorrhages, or any considerable disorganization of cerebral substance, is sooner or later followed by impairment of the mental faculties, as is shown by an impaired memory, tardy, inaccurate, and feeble connection of ideas, irritability of temper, easily excited emotions, etc.

Localization of Special Centers and their Functions.

Investigations of Charcot, Ferrier, Broca, Türck, Luys, and others have proven the fact that there are certain centers whose areas can be pretty accurately mapped out and their functions clearly defined. The most clearly defined of all these centers is the *motor center.*

The Motor Center.

There are certain parts of the cerebral convolutions where stimulation always produces definite and unmistakable movements on the opposite side of the body. This area, termed the motor area, includes the basis of the three frontal convolutions, the ascending frontal and the ascending parietal

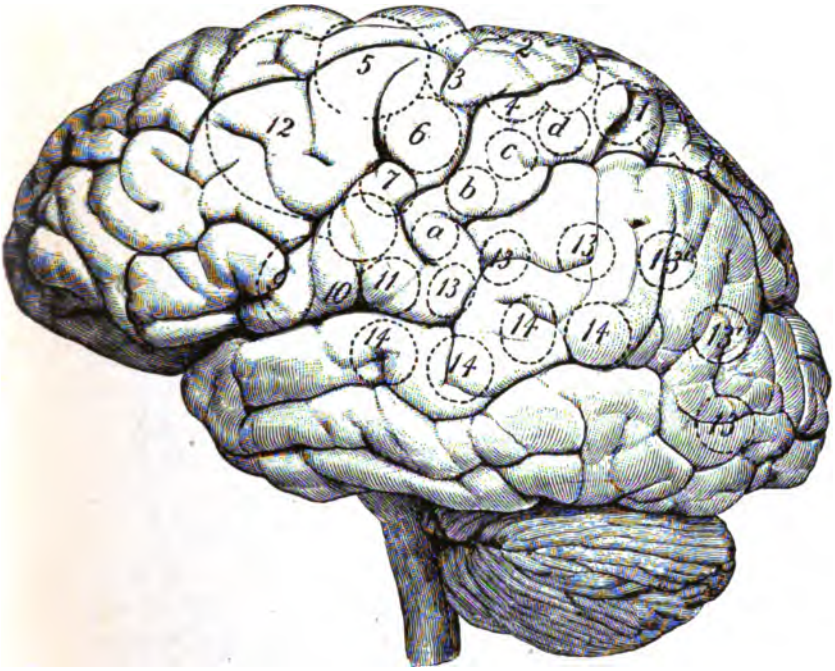

FIG. 15.—SIDE VIEW OF THE BRAIN, SHOWING THE SITUATION OF CERTAIN GROUPS OF CELLS OR "CENTERS" IN THE CORTEX THAT PRESIDES OVER PARTICULAR FUNCTIONS. (After Ferrier.) 1, center for movements of opposite leg and foot; 2, 3, 4, centers for complex movements of the arms and legs, as in swimming; 5, extension forward of the arm and hand; 6, supination of the hand and flexion of the forearm; 7, 8, elevators and depressors of the angle of the mouth; 12, movements of the eyes; 13, vision; 14, hearing; *a*, *b*, *c*, *d*, movements of the wrists and fingers. (After Gray.)

convolutions, the para-central lobule, and the superior parietal convolution.

Not only have the centers for the various movements of the limbs been found, but also centers which produce certain definite and never-varying motions have been discovered. It is generally found that the centers governing large muscles are higher up on the surface of the brain than those governing small muscles; for example, the center for the movement of the muscles of the shoulders are highest, then those for the lower arm and wrist come next, while those governing the hand come

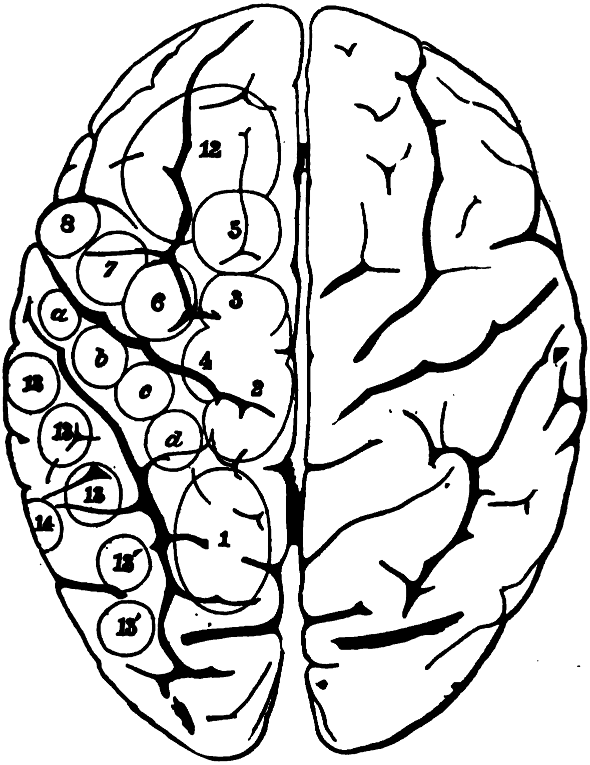

FIG. 16.—TOP VIEW OF THE BRAIN, SHOWING THE LOCALIZATION OF VARIOUS FUNCTIONS. References the same as in the preceding figure.

lowest. The various motor areas are nourished by the middle cerebral artery and its branches. Different areas are nourished by different branches. The function of one part may be destroyed by an embolus and yet the others still perform their functions. Clinical evidence goes to show that destructive lesions followed by paralysis of voluntary motion are confined to this motor area. There is not on record a single instance where the motor zone was destroyed in which there was not paralysis to a more or less extent; while, on the other hand, there is not another region of the brain which has not been the subject of destructive lesions without any motor paralysis whatever. When sudden hemiplegia occurs as a result of hemorrhage into, or traumatism of some portion of, the motor area, the condition of paralysis is liable to improve in those regions of the body where the special motor centers of that part remain unimpaired, but the paralysis will usually remain permanent in that part of the body whose motor center is destroyed. If the destruction involves the whole depth of the cortex, the paralysis is of an incurable type, and is accompanied by descending degeneration (sclerosis) of the pyramidal tracts of the spinal cord and contraction and rigidity of the paralyzed limbs.

The researches of Ferrier have shown that when paralysis of motion from disease of the opposite hemisphere occurs, the individual movements are not all equally affected (the hand is more paralyzed than the arm, the arm more than the leg, and the lower facial muscles more than the upper, while the muscles of the trunk are scarcely, if at all, affected); and that in the process of recovery some movements are regained before others. Thus it is found that after the effects of the shock of the attack have passed away, the muscles which are paralyzed are those which are most completely under the control of volition. That is, the more independent movements are most affected, while such as are usually associated in action with those of the opposite side are less paralyzed and recover more speedily. Thus it is found that when the arm and hand are perfectly powerless, some degree of volitional control over the leg and foot may still be retained.*

The facial muscles are never entirely paralyzed, and in particular the orbicularis oculi remains almost unaffected, so that the eye on the paralyzed side can be closed almost as well as the other. In this there is a marked contrast between facial paralysis due to a cerebral lesion and facial paralysis due to a lesion of the seventh cranial nerve. In the latter case the orbicularis oculi is *absolutely* paralyzed, so that the eye cannot be closed.

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* Blocq and Onanoff have demonstrated the fact that the upper extremities receive about three times as many fibers of cerebral origin as the lower extremities, and, considering the muscular mass of the two extremities (the arm and leg), the difference is about five to one. This accounts for the fact that in cerebral hemiplegia the upper extremity is usually more affected and slowest to recover.

Special Centers of Motion.

1. According to Ferrier, irritation of the area comprising the base of the superior and middle frontal convolutions gives rise to lateral movements of the head and eyes to the opposite side, with dilatation of the pupils. Grasset claims, however, that clinico-pathological evidence points rather toward the convolutions surrounding the posterior end of the fissure of Sylvius as the cortical region in which the occurrence of lesions tends to produce conjugate deviation of the eyes and head.

2. The motor center of articulate speech is located in the base of the third frontal convolution, sometimes called Broca's convolution. It presides over the co-ordination of muscular acts necessary to speech, and stores the memories of such acts. This center is connected by associating fibers with the centers of hearing and sight and with the nuclei of origin of the nerves which preside over the apparatus of speech.

Disease of this region on the left side produces aphasia. This aphasia is not due to a loss of memory of the words, but to an inability to co-ordinate the muscular acts necessary to speak the word; the patient being able to write the word correctly.

3. The area for the lower limb occupies the upper part of the ascending frontal and the ascending parietal convolutions, the base of the superior frontal convolution, and the whole of the superior parietal and the para-central lobule: the latter presides over the movements of the big toe.

4. On account of the varied and complex movements of the upper extremity, its center of motion occupies a much larger

area. It includes the basis of the superior and middle frontal convolutions and the middle third of the ascending frontal and ascending parietal convolutions.

According to Horsley, in the area described as pertaining to the upper limb, the uppermost part controls the muscles of the shoulder; below, and posteriorly, the elbow is represented; still further below and somewhat anteriorly, the wrist; next in order, anteriorly, the finger movements are placed; and lowest of all and posteriorly, the thumb movements are located.

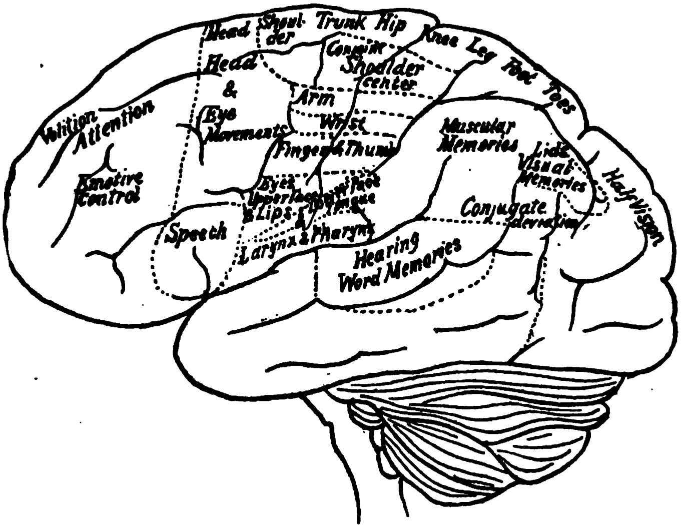

FIG. 17.—A DIAGRAM ILLUSTRATING THE FUNCTIONS OF DIFFERENT AREAS OF THE CEREBRAL CORTEX. (After Dana.)

5. The center for the face movements lies in the lower third of the ascending frontal and the ascending parietal convolutions; and, according to Horsley's researches, it is subdivided into: (*a*) an upper and anterior portion, which controls the upper part of the face and the angle of the mouth; (*b*) the anterior half of the lower portion, which governs the movements of the vocal cords; and (*c*) the posterior half of the lower portion, which governs the lower part of the face and the floor of the mouth.

The motor centers of the facial muscles occupy a region in close proximity to those of the arm and hand; and it is an exception to the general rule to observe facial paralysis of the cerebral type—that is, paralysis limited almost exclusively to the lower facial region, occurring by itself in connection with cortical disease. Usually it is complicated with brachial paralysis or with aphasia; with the latter more especially when the lesion is in the left hemisphere.

6. The motor centers for the trunk muscles are located the highest of all, being located at the upper part of the ascending frontal and ascending parietal convolutions.

The lines of limitation for these various centers are not definitely marked, but overlap one another; as an example of this, when the hand is brought into powerful action, there is usually retraction of the angle of the mouth; also paralysis of the lower extremity, when due to cerebral lesion, is seldom separated from a similar condition of the upper extremity.

Sensory Area.

The seat for general sensation covers a much larger area than the motor and is not so well defined. Clinical and experimental observation is direct in motor phenomena, indirect and inferential in sensory phenomena. Progress in the latter direction has therefore been much slower, both from the inherent difficulty of the subject and the greater liability to fallacy.

The area of common sensation includes the greater part of the parietal lobes, overlapping the motor centers; also the temporal and occipital lobes. The area for tactile sensation is confined to the parietal convolution, overlapping the motor region. Ferrier is of the opinion that the tactile centers are situated in the hippocampal region.

Visual Center.

The visual center, or center of sight, is located in the occipital lobes and the angular gyri.

The following deductions are made from Ferrier's experiments: 1. That the occipital lobes may be removed without any appreciable impairment of the faculty of clear vision. 2. That unilateral destruction of the angular gyrus produces only transient loss of vision in the opposite eye. 3. That even bilateral destruction of the angular gyrus does not cause permanent loss of vision. 4. When, however, the angular gyrus and occipital lobe are together destroyed in the one hemisphere, transient amblyopia occurs in the opposite eye and hemianopsia in both eyes toward the side opposite the lesion, by reason of paralysis of both retinæ on that side. 5. That in order to cause complete and permanent loss of vision in both eyes it is necessary to completely extirpate both angular gyri and both occipital lobes.

Henschen (as quoted by the *North American Journal of Homeopathy*, August, 1895), by the method of exclusion, arrives at the conclusion that the visual (cortical) center is in the inner face of the occipital lobe. Every lesion involving the whole inner face is accompanied by hemianopsia. All the cases where the calcarine fissure was destroyed had hemianopsia. On the other hand, there are a number of cases in which the lesion affected only the cortex of the cuneus or of the lobus lingulis without involving the calcarine fissure—in these cases hemianopsia was not present. Analysis of all the known cases in the literature shows that the visual center is in the cortex of the calcarine fissure.

According to Henschen's results, the retina is represented as buried in the fissure, the dorsal quadrants of the retina being represented in the upper wall of the fissure, the ventral quadrants in the lower wall, and anteriorly at the bottom of the fissure the macula lutea is represented.

According to Spitzka, there is an area in the brain (the cortex of the calcarine fissure, its neighborhood, and a considerable extent of the convexity of the occipital and possibly of the parietal lobes) which is known to be the central abutment of the fibers connected with the optic tracts. Here the impressions occurring in the retina and transmitted through the optic nerves, tracts, and radiations are registered as memories.

According to the view of Munk, each occipital lobe presides over the vision of the corresponding half of each eye; the left lobe over the left half, and the right over the right half, of each eye.

Auditory Center.

The auditory center, or center of hearing, is located in the first temporo-sphenoidal convolution.

Olfactory Center.

The centers for taste and smell are located in the tips of the temporo-sphenoidal lobes. Zuckerkandl, from researches in comparative anatomy, is of the opinion that the olfactory center has its seat in Ammon's horn.

Thus far no definite region of the cortex has been proved to be exclusively the seat of sexual sensations and impulses; but, owing to the close relations which exist between the sexual instinct and the olfactory sense, it is to be presumed that the sexual and olfactory centers lie close together in the cerebral cortex. (Krafft-Ebing.)

Intellectual Center.

The cortex or gray matter of the cerebrum, as a whole, must be regarded as the organ of the mind. Yet, notwithstanding this general proposition, the center for the seat of intelligence or the highest mental faculties is, without doubt, located in the frontal lobes. The reason for this conclusion is the highly developed frontal lobes in the higher races of mankind, and their constant decrease as the degree of intellect descends, along with the fact that stimulation of these regions produces no appreciable motor effects in the lower animals. In some of the lower animals the frontal lobes are small and in others they are only in a rudimentary state, while in man they reach their greatest development.

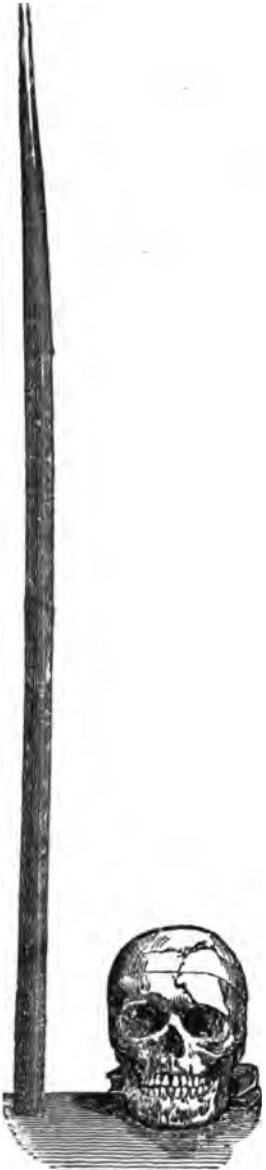

FIG. 18. FIG. 19.

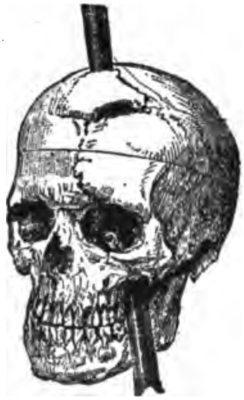

FIG. 20.

FIGS. 18, 19, 20.—ILLUSTRATIONS OF DR. HARLOW'S CASE OF THE PASSAGE OF AN IRON BAR THROUGH THE HEAD. (After Ferrier.)

Lesions of these lobes (excepting their bases) cause no motor or sensory symptoms. There are many instances on record in which these regions have been the seat of extensive disease on one or both sides, with a like negative result as regards sensation or motion; and recovery has taken place after the most frightful operations and loss of substance. One of the most remarkable of these is that known as the "American Crowbar Case."

Ferrier gives the following description of this case: "The subject of the lesion was a young man, Phineas P. Gage, aged twenty-five. While he was engaged tamping a blasting charge in a rock with a pointed iron bar 3 feet 7 inches in length, 1¼ inch in diameter, and weighing 13¼ pounds, the charge suddenly exploded. The iron bar, propelled with the pointed end first, entered at the left angle of the patient's jaw and passed clean through the top of his head, near the sagittal suture in the frontal region, and was picked up at some distance, covered with 'blood and brains.' The patient was for the moment stunned, but within an hour after the accident he was able to walk up a long flight of stairs and give a surgeon an intelligent account of the injury he had sustained. His life was naturally for a long time despaired of; but he ultimately recovered, and lived twelve and a half years afterward."

Immediately following this accident the opinion was advanced by a few writers that the seat of intelligence could not be located in the anterior lobes, for apparently the mental capacity of this individual was not impaired; but the subsequent history of the case showed otherwise, for his memory became defective, he was incapable of applying himself to any pursuit requiring any mental activity, and finally he died of epileptic convulsions.

Lesions of the anterior lobes often occur without producing any very definite mental defects. Still, at other times, distinct alterations in the general character and disposition of the individual, followed by aberration and weakness of the mental faculties, have resulted from disease of the anterior lobes of the brain, especially if the lesion was diffuse and extensive, extending over a number of convolutions.

It is generally supposed that the frontal lobes must be affected in order to produce mental disease; but this has been disproved by clinical observation, which goes to show that lesions in the different lobes, if diffuse and involving several convolutions, may cause marked mental symptoms.

Diagnosis of Cortical Lesions.

1. **Lesions of the Motor Centers.**—The conclusions of Ferrier in regard to the diagnosis of cortical lesions may be summarized as follows: (*a*) In cortical affections we frequently find hemiplegia at first complete, resolving itself into a monoplegia; or a monoplegia becoming a hemiplegia by progressive advance of the disease to other motor centers. This latter is a significant indication of cortical disease. (*b*) Cortical paralysis is frequently erratic and transitory, more especially in connection with superficial or meningo-encephalitis; appearing and vanishing, first on one side and then on the other. According as the lesion is superficial or involving the whole depth of the cortex and subjacent medulla, we get transitory paralysis, or paralysis that remains permanent, and is followed by descending sclerosis and late rigidity. (*c*) Early rigidity is of frequent occurrence in cortical disease, rare in central cerebral disease. (*d*) Consciousness is less frequently lost in cases of sudden cortical lesion than when similar disease occurs in central ganglia. This is to be accounted for by the special tendency in the latter case to sudden displacement of the cerebro-spinal fluid, and, through this, general disturbance of the cerebral circulation. (*e*) Cortical lesions are more frequently accompanied by localized pain in the head; and even when the pain is not spontaneously complained of, it may be brought out by percussion over the seat of the lesion.

Lesions confined entirely to the motor centers do not cause hemianæsthesia; there may be a slight degree of numbness, but not an entire loss of sensation. Cortical lesions of the motor center usually produce a monoplegia; rarely do they produce a hemiplegia. When, however, the lesion extends through the cortex, it may produce a hemiplegia resembling in every respect one produced by a central lesion; and in neither case is the nutrition or electric contractility of the paralyzed muscles directly impaired. Sensation is not affected in either case if the lesion be strictly confined to the motor cortex, or to the anterior two-thirds of the internal capsule.

2. Jacksonian epilepsy is due to an irritative lesion of the cortex, manifested by convulsions, which are followed by transient attacks of paralysis. The majority of these cases are due to syphilitic gummata pressing upon the cortex.

3. Lesion of the base of the third frontal convolution and the island of Reil causes ataxic aphasia.

4. Lesion of the first temporo-sphenoidal lobe causes loss of hearing.

5. Lesion of the tips of the temporo-sphenoidal lobes is liable to cause impairment of taste and smell if destructive in character, or subjective odors and tastes if irritative in character.

6. Irritative lesions of the cortex of the cuneus, a part of the occipital, may cause hallucinations of vision.

7. Word-deafness is an inability to recognize the meaning of spoken words; this indicates an impairment of the memories of sound; thus indicating a lesion of the superior parietal convolutions, in which such memories are stored.

8. Word-blindness is an inability to recognize written or printed language, and indicates a loss of sight memories; therefore it would point toward a lesion of the occipital cortex.

9. Delirium, convulsions, and local pain, which may or may not be followed by coma or paralysis, are indicative of lesions diffused over a large surface of the cortex. This may be caused from the exudation of acute meningitis pressing upon the cortex, thereby producing an anæmic condition, and consequently an impairment of nutrition to the underlying structures.

Basal Ganglia.

Each hemisphere forms a kind of hollow shell, inclosing and overlapping two nodal masses of gray matter, called the *basal ganglia*.

These masses are named the corpus striatum and the optic thalamus, and are visible when the cavity of the hemisphere has been laid open by division of the corpus callosum, or when the hemispheres are drawn asunder and pushed upward and forward.

Corpora Striata.

The corpus striatum, so called from its striped appearance, is a pear-shaped body situated at the base of the brain, with its rounded base directed forward and the narrower end backward and outward. Its external surface is gray, and it presents on section alternate striæ of white and gray matter, the gray forming the larger part of its substance. It is divided into two parts by the internal capsule, the extra-ventricular portion, or *lenticular nucleus*, and the intra-ventricular, or *caudate nucleus*. The extra-ventricular portion comprises the greater part of this body; it is wedge-shaped, its base being directed toward the frontal lobe and the island of Reil, while its point passes backward and outward. The intra-ventricular portion is a pear-shaped mass, of a gray color externally; its broad extremity is directed forward into the fore part of the body and anterior cornu of the lateral ventricle; its narrow end is directed outward and backward.

Function of the Corpora Striata.—The corpus striatum is brought into communication with the cerebrum, cerebellum, and spinal cord by means of afferent fibers. The afferent fibers consist of: (1) The radial fibers springing from the cortex of the cerebrum; (2) fibers springing from the cortex of the central lobe; (3) fibers springing from the olfactory lobe; (4) fibers from the cerebellum.

Luys has advanced the theory that some of these fibers are the wires which carry the continuous currents of electric force which overflow from the cerebellum to the corpus striatum, and thus constantly charge the cells of that body, which are liable to become exhausted by the controlling influence exerted by them over motor impulses transmitted from the cortex of the cerebrum, and that the corpus striatum may be considered as a territory in which cerebral, cerebellar, and spinal activities are brought into intimate communication.

Mynert regards the corpus striatum as a " ganglion of interruption " of the fibers connecting the cerebral cortex with the periphery.

It acts as a halting-place for voluntary motor impulses emitted from the cerebral cortex. It enables these impulses to become modified and possibly reinforced by currents derived from the cerebellum, and by its efferent fibers it transmits centrifugal motor impulses along the projecting system to different groups of cells within the spinal gray matter, whose individual function they tend to evoke.

Ranney says that the ganglion probably acts as a condenser and modifier of all motor acts which are the result of volition, and manifests through the agency of its satellites, the cells of the anterior horns of the gray matter of the spinal cord, the outward expression of our personality. Without the influence of the cerebral hemispheres, it is also capable, by means of the cerebellar innervation, of governing all complex muscular movements required in maintaining equilibrium. Finally, it may be presumed to possess the power of analysis of cerebral and cerebellar currents received simultaneously and of materializing them by the intervention of its nerve-cells, projecting them in a new form, amplified and incorporated with the requirements of the general organism.

The efferent fibers are composed of those which go to make up the crus cerebri, passing on to the different segments of the cord.

On account of the extreme friability of the corpus striatum, it is the most frequent seat of cerebral apoplexy. A destructive lesion of the corpus striatum will cause hemiplegia of the opposite side of the body, the paralysis being entirely confined to motion, sensation being in all respects unimpaired.

Optic Thalami.

The optic thalami are two oblong bodies situated back of and between the diverging portions of the corpora striata and resting upon the crura cerebri on the two sides. They are separated from each other by a space, the *third ventricle*. Externally they are separated from the corpora striata by the *internal capsule*.

They are white externally, and in their interior they present a mixture of white and gray matter; the gray constitutes the greater portion.

The optic thalami are connected by means of the corona radiata (the radiating fibers) with the various regions of the cortex—namely, the frontal, parietal, occipital, and temporal regions; also with the island of Reil, and with the hippocampal region by means of the pillars of the fornix.

The optic thalami appear to bear the same relations to the sensory regions of the cortex (that is, presiding over the sensory impressions) that the corpora striata do to the motor regions (that is, presiding over motor impulses). Although Todd, Carpenter, and others have regarded the optic thalami as centers for sensorial impressions, Luys, more than any other physiologist, has elaborated this idea. His doctrine is that the optic thalami are reservoirs for all sensorial impressions coming from the periphery of the nervous system; and that, like other ganglionic masses, they elaborate these impressions, and then pass them on to the cortex by means of the corona radiata.

According to his researches, the body of the optic thalamus is made up of four separate ganglionic masses: (1) Anterior, or olfactory; (2) middle, or optic; (3) median, or general sensory; (4) posterior, or auditory.

The anterior, or olfactory, he claims, is developed in animals in proportion to the acuteness of the sense of smell, and that it is the point of concentration of the olfactory impressions before they radiate toward the cortical periphery. The middle, or optic, may be considered as the seat of condensation and radiation of visual impressions. As an example, he states that it is scarcely visible in the mole, where the optic nerves are rudimentary. To the median, or general sensory, he ascribes the function of presiding over and condensing all sensory impressions. The posterior, or auditory, acts as a halting-place and condenser of auditory impressions. As proof that this is an auditory center, he cites two instances where the brains of deaf mutes were found to present a local lesion of this center.

Internal Capsule.

Between the caudate nucleus and the lenticular nucleus in front is a broad band of white fibers, which is continuous with the band of white fibers lying posteriorly between the lenticular nucleus and the optic thalamus on either side. This band is termed the "internal capsule." The portion of the internal capsule which lies between the caudate nucleus and the lenticular nucleus is called the anterior division. That part situated between the lenticular nucleus and the optic thalamus is known as the posterior division. The bend where the posterior division of the internal capsule joins the anterior division is termed the knee or "genu" of the capsule.

The internal capsule is made up of (*a*) motor fibers, which pass from the cerebral cortex to the basis cruris, then to the spinal cord, thus making a direct continuation between the cortical region bounding the fissure of Rolando and the pyramidal tracts of the spinal cord; (*b*) sensory fibers passing from the posterior columns of the cord, by way of the tegmentum cruris, to the cortex, thereby forming a direct continuation between the spinal cord and the sensory regions of the cortex; (*c*) fibers which have their origin in the gray matter of the corpora striata and optic thalami, and which curve outward and upward to go to the gray matter of the hemispheres. These latter fibers compose the greater part of the internal capsule.

As has been stated, many of the radiating fibers are continuous from the crura cerebri to the cortex of the brain, seemingly having no relation to the basal ganglia; many others pass through the substance of the basal ganglia, without any apparent structural relation with the nerve-cells within them; but the greater part of the fibers of the basis cruris and tegmentum cruris, however, pass directly into the corpora striata in front and the optic thalami behind. Yet more fibers leave the basal ganglia than enter them, and it is these fibers that are usually termed the internal capsule. Strictly speaking, then, the internal capsule ceases at the optic tracts below and at the upper level of the lenticular nucleus above, for after they pass the latter point they are known as the corona radiata.

Function of the Internal Capsule.—The portion of the internal capsule situated anterior to the knee contains those fibers which are distributed to the frontal regions of the cortex, and their function is not very well understood. The anterior two-thirds of the posterior division, the part lying just back of the knee, is the tract for the motor fibers, passing from the motor area of the cortex down to the spinal cord. Any lesion affecting these fibers, or the cortex from which they spring, will cause paralysis of motion (hemiplegia) of the opposite side of the body from the lesion, followed later by a descending degeneration of the nerves.

Choreic movements following an attack of hemiplegia are strongly indicative of a lesion of the internal capsule.

The posterior third of the internal capsule contains, in addition to the fibers extending upward from the posterior part of the spinal cord (the columns of Goll and Burdach), the fibers derived from the optic tracts, and their connection with the corpora geniculata, optic thalami, and the corpora quadrigemina; also the paths for the other special senses, as those of hearing, taste, and smell.

Lesions that affect the posterior portion of the internal capsule cause hemianæsthesia of the opposite side of the body from the lesion.

External Capsule.

External to the lenticular nucleus is a band of white substance, called the *external capsule,* in which there is a band of gray matter, called the *claustrum.* These parts are rarely affected alone by lesions, and when so affected produce no marked symptoms.

The Gray Matter of the Brain.

The gray or cellular matter of the brain is found in the following locations: (1) The cortex of the cerebrum; (2) the basal ganglia; (3) the cerebellum; (4) the central or tubular gray matter; (5) aggregations of cells within the substance of the crus cerebri, pons Varolii, and medulla.

The central or tubular gray matter of the brain is an aggregation of cells lining the upper part of the cerebro-spinal tube, which is the remains of the cavity in the original vesicle in which the brain is formed.

This gray matter lines the floor of the third ventricle, the aqueduct of Sylvius, the floor of the fourth ventricle, and is continuous with the central gray matter of the cord. It forms the following parts: the middle or gray commissure of the third ventricle, the tubercinereum, the infundibulum, the lamina cinera, and the posterior perforated space; it also forms the nucleus of origin of the deep roots of all the cranial nerves except the first and second.

The White Matter of the Brain.

The white matter of the brain is composed of nerve-fibers. These nerve-fibers may be divided into five classes or sets.

1. The commissural. These are the fibers which connect homologous regions of the two hemispheres together, thereby aiding the two hemispheres to act in unison when circumstances demand it. They compose about one-half of the white substance of the brain, and they are supposed to be sufficient in number to connect each cell with a corresponding cell in

the opposite hemisphere. These are the transverse fibers of the callosum.

2. The radiating, converging, or peduncular fibers. These are the fibers which connect the brain with the spinal cord. These fibers do not pass to the opposite hemisphere. Many of the radiating fibers (the motor portion) in their course from the cortex of the brain to the crura, and from the crura to the cortex (sensory portion), pass through the corpus striatum (motor fibers) and optic thalamus (sensory fibers); others pass these ganglia without having any connection whatsoever with their cells. The most of these fibers pass through the internal capsule. The fibers from the anterior and middle portion of the cerebrum (motor) occupy the anterior two-thirds of the posterior division of the internal capsule. The fibers from the posterior portion of the cerebrum (sensory) are found in the posterior third of the posterior division of the internal capsule.

From the internal capsule the fibers pass in the crus cerebri to the upper border of the pons Varolii; thence through the pons forming its longitudinal fibers. The motor fibers pass to the anterior pyramids of the medulla oblongata, where the most of them decussate and then pass on to the spinal cord, forming the *crossed pyramidal* tracts; the lesser number continue on to the spinal cord as the direct pyramidal tracts or the columns of Türck. The sensory fibers go to the posterior part of the spinal cord, forming the columns of Goll and Burdach. The function of the radiating fibers is to transmit *motor impulses* from the motor regions of the cortex to the muscles of the trunk and extremities, and *sensory impressions* from the periphery to the sensory portions of the cortex.

3. Associating or arcuate fibers, fibers passing in a curved direction from one convolution to another. These are the fibers which connect the different cerebral convolutions on the same side. These fibers do not pass to the opposite hemisphere.

4. Fibers connecting the cerebrum with the cerebellum.

5. Fibers that connect the cortex of the temporo-sphenoidal lobes with the optic thalamus.

Crura Cerebri.

The crura cerebri, or peduncles of the cerebrum, are two short, thick, rounded bands of white fibers, which pass from the cerebral hemispheres to the upper borders of the pons Varolii. Each crus is about three-quarters of an inch in length, and somewhat broader in front than behind. The crura cerebri are composed of longitudinal white fibers, which serve to connect the various parts with the cerebrum. Each crus is divided into a superficial and deep layer by the *locus niger* (a mass of dark gray matter, so called owing to its containing darkly pigmented cells almost black in appearance). The superficial band is called the *basis cruris* (crusta or crusta cruris), the fibers of which are connected chiefly with the nuclei of the corpus striatum, which constitutes its crown or cap, as it were. This may be regarded principally as the centrifugal or motor tract.

The deep band is called the *tegmentum cruris*, the fibers of which are connected chiefly with the optic thalamus and the corpora quadrigemina. This may be considered as the chief tract for the centripetal or sensory fibers. The basis curis consists of white fibers only; while in the tegmentum cruris the fibers are mixed with masses of gray matter.

Ranney, in describing the crura cerebri, says: "The motor tracts of the basis cruris become joined to cells in the gray matter of the spinal cord, which are connected with the anterior or motor roots of the spinal nerves. The fibers of the tegmentum cruris unite with similar cells which lie more posteriorily, and are associated with the posterior or sensory roots of the cranial and spinal nerves. Each separate nerve-fiber is interrupted in its course by the *interpolation of a ganglion cell* before it reaches the particular spinal nerve, with the action of which it is to become intimately associated. The nerve-cells of the spinal cord help to explain the various phenomena

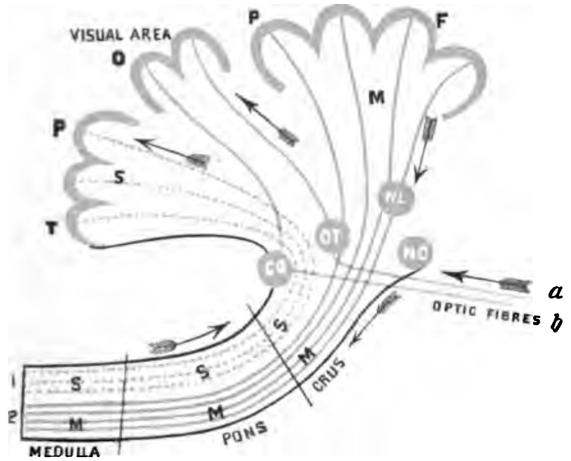

Fig. 21, Plate III.—A Diagram Designated to Show the General Course of Fibers of the "Sensory" and "Motor Tracts," and their Relation to Certain Fasciculi of the Optic Nerve Tracts.—(Ranney's Modification from Seguin.) *S*, sensory tract in posterior region of mesocephalon, extending to *OP* and *T*, occipital, parietal, and temporal lobes of hemispheres; *M*, motor tract in basis cruris, extending to *P* and *F*; parietal and (part of) frontal lobes of hemispheres; *CQ*, corpus quadrigeminum; *OT*, optic thalamus; *NL*, nucleus lenticularis; *NC*, nucleus caudatus; 1, the fibers forming the "tegmentum cruris"; 2, the fibers forming the "basis cruris"; *a*, fibers of the optic nerve which become associated with the "optic center" in the optic thalamus, and are subsequently prolonged to the "visual area" of the occipital convolutions of the cerebrum; *b*, optic fibers which join the cells of the "corpora quadrigemina," and are then prolonged to the visual area of the cerebral cortex.

which come under the head of spinal automatism, or reflex action. By the interpolation of nerve-cells in the course of nerve-fibers, sensory impressions may be carried to any one of the three main divisions of gray matter—namely, the tubular *gray substance and its expansions*, the *basal ganglia*, or the cortex of the cerebrum—and there excite a response in the form of a motor impulse."

The Corpora Quadrigemina, or Optic Lobes.

The corpora quadrigemina are four rounded eminences or tubercles, placed in pairs, two in front and two behind. The anterior pair of tubercles are termed the *nates*, and the posterior pair the *testes*. These ganglia lie between the cerebellum and the optic thalami. The connection with the cerebellum is through the superior peduncles of the cerebellum *(processus e cerebello ad testes)*. Between these two processes, which extend from the anterior part of the cerebellum to the posterior margin of the testes, is a thin transverse lamina, called the *valve of Vieussens*.

The corpora quadrigemina are connected with the optic thalami (and the commencement of the optic tracts) by means of two white bands of fibers on each side, the brachia. Those connecting the anterior pair, or nates, are called the brachia anteriora. Those connecting the posterior pair, or testes, are called the brachia posteriora. The brachia from the anterior tubercle, or nates, are continuous with the optic tracts through the corpora geniculata laterala, and may be considered as the superficial origin of the tracts. According to the researches of Von Gudden, the brachia of the testes, or posterior tubercles, pass into the corpora geniculata media, and from these tubercles are traceable to certain portions of the optic tracts, which, however, form a commissure in the chiasm (the inferior commissure) and do not appear to enter into the composition of the optic nerves.

These bodies are larger in the lower animals than in man. In fishes, reptiles, and birds they are only two in number, and are called the *optic lobes,* from their connection with the optic nerves, and are hollow in their interior; but in mammalia they are four in number, as in man, and quite solid.

Function of the Corpora Quadrigemina.—We have no direct evidence of the function of these ganglia, but the anatomical connection between the optic tracts and the anterior quadrigeminal tubercles is sufficient to indicate that these centers have some important relation to retinal impressions. But it would not follow that they are visual centers proper, even though destructive lesions should cause blindness, for such lesions would necessarily break the continuity of the optic tracts in their more or less direct paths to the true centers of vision in the cerebral hemispheres.

Ferrier's researches go to show that, though not the centers of vision proper, they are centers of co-ordination between the retinal impressions of vision and motor reactions or adjustments of considerable complexity; or, in other words, they are the centers of correlation between retinal impressions and oculo-motor reactions. In man the corpora quadrigemina are scarcely ever the seat of isolated disease, and it is difficult, if at all possible, to differentiate clearly between the effects of lesions of the quadrigeminal lamellæ proper and those of the tracts with which they are related.

Corpora Geniculata.

The corpora geniculata are four small rounded eminences of gray matter which are continuous with the gray substance of the optic thalami. There are two on either side, placed on the outer side of the corpora quadrigemina and on the under and back part of each optic thalamus, and named, from their position, *corpus geniculatum externum* and *internum.* The two bodies are separated from one another by one of the roots of the optic tracts.

The corpora geniculata are connected with the following parts: The brachia from the anterior tubercles of the quadrigemina pass to the corpora geniculata externa, thence into the optic tracts; the brachia of the posterior tubercles pass directly forward and appear to end in the corpora geniculata interna. Functionally these bodies are associated with the visual centers.

Corpus Callosum.

The cerebral hemispheres are connected together by a great system of commissural fibers, the *corpus callosum*, which forms the floor of the longitudinal fissure and the roof of the lateral ventricles. It is about four inches in length, extending to within an inch and a half of the anterior and to within two inches and a half of the posterior part of the brain. It presents a somewhat arched appearance, being broader behind than in front and thicker at either end than in the middle.

The anterior band is called the "genu" of the callosum; posteriorly it forms a thick, rounded fold—the "splenium." The fibers of this system are, in the middle, mainly transverse, but as they enter the hemisphere they diverge in various directions, so as to reach all parts of the hemispheres to which the corona radiata are distributed.

The Fillet, or Lemniscus.

The fillet (a ribbon) is a layer of fibers that lies between the crustal and tegmental portions of the pons. It extends also through the crus cerebri, appearing superficially as a triangular band, winding obliquely around the superior peduncles, from the funiculus olivarius to the corpora quadrigemina. It seems to consist of two distinct sets of fibers; one of which undergoes descending degeneration, and the other ascending degeneration, when separated from their trophic centers. The conclusion to be drawn from this is that they carry impulses that correspond to the form of degeneration that they undergo, one centrifugal and the other centripetal.

The centrifugal tract arises from the external division of the lenticular nucleus and the corpus striatum. and terminates in the olivary body.

The centripetal tract arises in the interolivary layer at the sensory decussation of the medulla, and, according to Spitzka, is probably a continuation of the column of Goll, and, in part, of that of Burdach toward the cerebrum, and conducts chiefly centripetal impressions from the muscles.

Some of the fibers of this tract pass to the posterior corpora quadrigemina (testes cerebri); others pass up to the posterior part of the internal capsule and radiate with these capsular fibers to the center and parietal cortex.

Functions of the Fillet.—There seems to be a relationship between the lemniscus and the so-called muscular sense. The latest researches go to show that the fibers governing co-ordination pass through this fillet, and any lesion affecting it is followed by ataxia.

Commissures of the Third Ventricle.

The cavity of the third ventricle is crossed by three commissures, named, from their position, *anterior*, *middle*, and *posterior*.

The anterior commissure is a band of white fibers which passes in front of the anterior crura of the fornix. It apparently connects the corpora striata, but the fibers have no anatomical relationship to the cells of these ganglia. The fibers perforate the corpora striata and pass out into the substance of the hemisphere over the roof of the descending horn of each lateral ventricle. It is composed of two sets of fibers: (*a*) An *olfactory* portion, connecting the two bulbs of the olfactory nerves; (*b*) a *temporal* portion, connecting the temporal lobes of the two hemispheres.

The fibers of the posterior division are traceable outward to the region of the hippocampal lobule and nucleus amygdalæ, and is obviously a commissure of centers related to the olfactory organs.

The middle or soft commissure consists almost entirely of gray matter. It connects together the optic thalami, and is, in fact, an integral part of the thalami. The middle commissure is sometimes absent.

The posterior commissure is a flattened band of white fibers which lies above the upper end of the aqueduct of Sylvius, connecting together the posterior extremities of the two optic thalami. It seems to be a continuation of the fibers of the fillet. The fibers apparently spring from the tegmentum, and, after decussating, appear to traverse the substance of the thalamus, and then to radiate in the white substance of the hemisphere of the cerebrum.

Perforated Spaces.

The anterior perforated space, so called on account of its being perforated by numerous orifices for the passage of blood-vessels to the corpora striata, is a triangular, grayish-colored body, situated at the inner side of the fissure of Sylvius, and is bounded in front by the convolutions of the anterior lobe and the roots of the olfactory nerve; behind, by the optic tracts; externally, by the fissure of Sylvius and the middle lobe; internally it is continuous with the lamia cinerea.

The posterior perforated space, so called on account of its being perforated by numerous small apertures for the passage of blood-vessels to the optic thalami, is a whitish gray substance, situated between the corpora albicantia in front, the pons Varolii behind, and the crura cerebri on either side. It forms the back part of the floor of the third ventricle.

Tuber Cinereum.

The tuber cinereum is an eminence of gray matter situated between the optic tracts and the corpora albicantia; it is connected with the surrounding parts of the cerebrum, forms part of the floor of the third ventricle, and is continuous with the gray substance in that cavity. (Gray.)

From the middle of its under surface a conical tubular process of gray matter, about two lines in length, is continued downward and forward to be attached to the posterior lobe of the pituitary body; this is the *infundibulum.*

Pituitary Body.

The pituitary body, formerly called "pituitary gland," is that portion of the brain which lies in the sella Turcica of the sphenoid bone.

It is a small, reddish mass, which consists of two lobes, of which the anterior is the larger and embraces the posterior. The function of the pituitary body is unknown. It was formerly supposed to discharge "pituita" into the nostrils.

Corpora Albicantia.

The corpora albicantia are two small round white masses, each about the size of a pea, placed side by side immediately behind the tuber cinereum.

They are formed by the anterior crura of the fornix, and are composed externally of white substance and internally of gray matter, the gray matter of the two being connected by a transverse commissure of the same material.

Velum Interpositum.

The velum interpositum is a prolongation of the pia mater into the interior of the brain. It is triangular in shape, its base corresponding to the transverse fissure, its apex lying between the foramina of Monroe. It separates the under surface of the body of the fornix from the cavity of the third ventricle.

The Fornix.

The fornix, so called because it has a somewhat arched appearance, is a thin layer of white fibrous matter situated beneath the corpus callosum, with which it is continuous behind, but separated from it in front by the septum lucidum. Its under surface is separated from the third ventricle by the velum interpositum. It consists of two symmetrical halves,

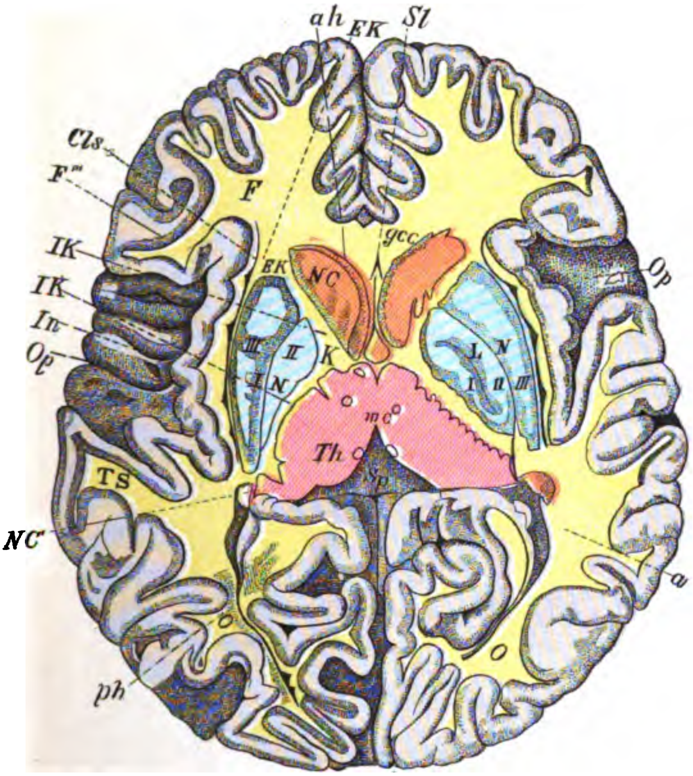

Fig. 22, Plate IV.—A Transverse Section of the Brain from Before Backward.—(Ranney's Modification from Flechsig.) *NC*, *caudate nucleus; NC*, the *tail* of *NC*, cut across (the amygdala); *LN*, *lenticular nucleus*, with its three subdivisions (I, II, III); *TH*, *optic thalamus; F*, frontal lobe; *TS*, temporo-sphenoidal lobe; *O*, occipital lobe; *Cls*, *claustrum; IK*, thalmo-lenticular portion of *internal capsule; K*, knee of same; *IK*, *caudo-lenticular* portion of same; *EK*, *external capsule*, lying between the lenticular nucleus and the claustrum; *f*, *fornix* cut across; *In*, *insula*, or *island of Reil; Op*, depth of Sylvian fissure beneath the operculum; *mc*, middle commissure of the thalamus; *ph*, posterior horn of lateral ventricle; *ah*, anterior horn of same; *Sl*, septum lucidum.

one located in each hemisphere; these two halves are joined together, constituting what is known as the body of the fornix.

The body is of a triangular form, the apex pointing forward, narrow in front and broad behind. Each lateral half of the fornix presents an anterior pillar or crura, which passes to the base of the brain and then curves upon itself in order to unite with the thalamus; and a posterior pillar, which enters the middle or descending horn of the lateral ventricle as a flattened ribbon-like band, called the *corpus fimbriatum.* This band terminates in the so-called *corpus dentatum* of the descending horn. (Ranney.)

The arched fibers of the body serve apparently to unite the tip of each temporo-sphenoidal lobe with the thalamus of the corresponding hemisphere, and, by their fusion in the mesial plane, to join the two hemispheres with each other.

Hippocampus Major.

The hippocampus major (cornu Ammonis), so called from its resemblance to a ram's horn, is a white eminence of a curved elongated form, extending throughout the entire length of the floor of the middle horn of the lateral ventricle. At its lower extremity it terminates in two or three finger-like processes, called the *pes hippocampi.*

Hippocampus Minor.

On the floor of the posterior horn of the lateral ventricle is seen a longitudinal eminence, called the *hippocampus minor,* and its digitated extremity, the *pes accessorius.*

Pons Varolii.

The pons Varolii is the bond of union of the various segments of the brain. It is situated at the base of the brain, just above the medulla, below the crura cerebri, and between the hemispheres of the cerebellum. It is composed of both transverse and longitudinal white fibers, and contains in its interior a large admixture of gray matter.

Its transverse fibers connect the two halves of the cerebellum; the fibers of each side becoming contracted into a thick, rounded cord, the crus cerebelli, enter the substance of the cerebellum, constituting its middle peduncle.

Its longitudinal fibers are connected below with the anterior pyramidal bodies and the olivary bodies of the medulla oblongata and the lateral and posterior columns of the cord. The fibers are connected above with the crura cerebri, and are continued on to the basal ganglia and the cerebral cortex.

In addition to the transverse and longitudinal fibers, the pons contains the nerve-fibers and nerve-nuclei of the cranial nerves and nodal masses of gray matter. It acts as a direct conductor of both motor and sensory impressions from and to the cerebrum, while the collection of gray matter within its substance proves it to possess some functions of its own which are independent of the stimulation of the cerebral cortex. This function probably regulates or in some way modifies those automatic movements which govern *station and progression.*

Flechsig's observations in regard to the course of various nerve-tracts in the pons and their relation to the gray substance in the pons are as follows:

1. A tract of nerve-fibers passes from the frontal lobes of the cerebrum, through the anterior division of the internal capsule and the inner two-fifths of the crus cerebri, to the gray nuclei in the antero-median gray matter of the pons. This tract of fibers is apparently prolonged, after traversing this gray mass, to the lateral and posterior portions of the cerebellum; here the gray substance of the pons must be regarded as interpolated in a tract which serves to unite the cerebellum with the frontal lobes chiefly, but not exclusively, of the opposed cerebral hemisphere.

2. The posterior median nuclei of the gray substance of the pons is similarly connected with a tract of fibers that joins the cerebellum with the cortex of the temporo-occipital region of the cerebrum. It never develops when the cerebellum is

wanting, and is not clothed with myelin until some months after birth. The course of this tract seems to be: (*a*) Through the extreme one-fifth of the crus; (*b*) through the internal capsule; (*c*) along the base of the lenticular nucleus of the corpus striatum; (*d*) outward to the cortex. The late development of these fibers apparently disproves any connection between them and the sense of hearing or of the tactile sense.

3. The caudate and lenticular nuclei of the corpus striatum are connected with the nuclei of the gray substance of the pons by means of fibers that pass downward through the median bundles of the crus to the substantia nigra and the nuclei of the pons. The fibers of this tract are connected with the cerebellum, after traversing these gray masses.

Lesions of the Pons.

1. A lesion of the upper and anterior half of the pons causes partial or complete hemiplegia and a facial paralysis both on the same side; but if the lesion is in the lower posterior part of the pons (below the line of Gubler—an imaginary line drawn between the superficial origin of the roots of the trigeminal nerves), the hemiplegia will affect one side of the body, while the facial paralysis will be on the opposite side of the body (crossed paralysis of the facial nerve and body type). This is due to a decussation of some of the nerve-fibers of the seventh pair in the region of Gubler's line. Ranney gives the following explanation of the occurrence of facial paralysis occurring on the same side, or on the opposite side from that of paralysis of the body:

" The facial nerve makes its exit from the side of the medulla oblongata; some of its roots of origin can be traced as far as the floor of the fourth ventricle, some come from the lower part of the medulla oblongata, while others descend from the upper border of the pons Varolii, and probably decussate. Now, a lesion existing in the lower half of the pons Varolii will, therefore, produce a paralysis of the corresponding facial nerve and of the opposite spinal nerves; whereas, if it occur above the point of decussation of the encephalic fibers, the paralysis will be on the opposite side or all parts of the body. These facts

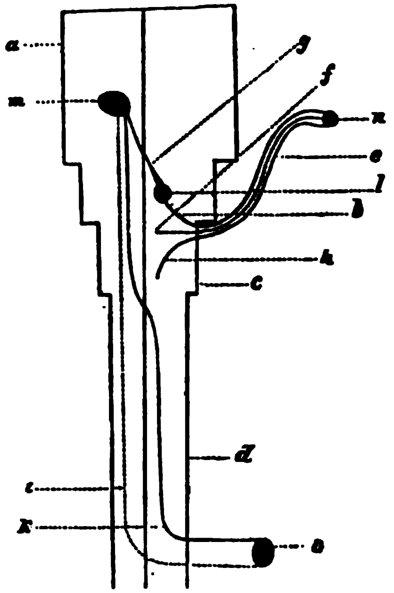

FIG. 23.—A DIAGRAM TO ILLUSTRATE THE METHOD OF PRODUCTION OF CROSSED PARALYSIS. (After Hammond.) *a*, the left hemisphere; *b*, right half of pons; *c*, right half of medulla oblongata; *d*, right half of spinal cord; *e*, right facial nerve; *f*, fiber of origin from nucleus in medulla oblongata; *g*, descending fiber, decussating at upper border of pons; *h*, ascending fiber; *i*, sensory root of spinal nerve; *k*, motor root of sensory nerve; *l*, lesion in pons; *m*, lesion in left hemisphere; *n*, paralyzed parts supplied by facial nerve; *o*, paralyzed parts supplied by spinal nerve. The facial nerve makes its exit from the side of medulla oblongata; some of its roots of origin can be traced as far as the floor of the fourth ventricle; others come from the lower part of the medulla oblongata, and others descend from the upper border of the pons, where they probably decussate. Now, a lesion existing in the lower half of the pons will, therefore, produce a paralysis of the corresponding facial nerve, and of the opposite spinal nerves; whereas, if it occur above the point of decussation of the encephalic fibers, the paralysis will be on the opposite side of the body. It is obvious, from a study of this diagram, that a lesion of one lateral half of the pons (at *l*) will cause paralysis of motion and of sensibility of the opposite side of the body generally, and of the corresponding side of the face, and that a lesion of the hemisphere (at *m*) will produce paralysis of the opposite side of the face and the body. It is true that it is not definitely settled by histological investigation that the decussation of the ascending roots takes place, but pathology is just as capable of determining the question as histology.

are shown in the accompanying diagram [Fig. 23]. It is obvious, from a study of this diagram, that a lesion of one lateral half of the pons (at *l*) will cause paralysis either of motion or of sensibility of the opposite side of the body, and of the corresponding side of the face; and that a lesion of the hemisphere (at *m*) will produce paralysis of the opposite side of the face and body."

2. General convulsions, followed by coma.
3. Vertigo.
4. Difficulty of deglutition and articulation.
5. Conjugate deviation of the eyeballs and head.

Grasset (as quoted by Bastian) has formulated the following rule in regard to conjugate deviation occurring in connection with lesions of the pons. In lesions of the pons Varolii, where conjugate deviation exists, the patient looks toward the paralyzed limbs when there is paralysis, and toward his lesion when there is spasm or convulsion.

This symptom is not pathognomonic, however, because it may occur also with cortical lesion of the cerebrum and lesion of the internal capsule.

6. Exaggerated knee-jerk on the side of the body opposite to the lesion.
7. Contraction of the pupils during an apoplectic attack is strikingly diagnostic of a clot within the pons.
8. Absence of mental disturbances.

Cerebellum.

The cerebellum is that portion of the encephalon which is contained in the inferior occipital fossa. It is situated beneath the posterior lobes of the cerebrum, from which it is separated by the tentorium.

It consists of a central portion, the vermis, and two lateral lobes or hemispheres. Both the central and lateral lobes are divided into numerous secondary divisions or lobules.

The interior is composed of a central stem of medullary fibers which radiate into the lateral lobes. The surface of these medullary radiations is covered with gray matter disposed in laminated folds. This arrangement gives to the cut surfaces of the organ a foliated appearance, to which the name arbor vitæ has been applied.

In the center of the medullary stem of each lateral lobe of the cerebellum there is a collection of gray matter, termed the *corpus dentatum.*

Structure of the Cerebellum.

The cerebellum consists of gray and white matter; the gray matter is found: (1) On the surface forming the cortex; (2) as independent masses in the interior.

The white matter of the cerebellum consists of: (1) Commissure fibers, which connect the opposite hemispheres; (2) associate fibers, which connect the laminæ with one another.

Peduncular Fibers.—The peduncles of the cerebellum are: (1) Superior, (2) middle, (3) inferior, and serve to connect the cerebellum with the rest of the encephalon.

The Superior Peduncle of the Cerebellum.

(Processus e cerebello ad testes.) The origin of the fibers of this process is diffused over the cerebellum, but the greater majority take their origin particularly from the corpus dentatum. The greater majority of the fibers decussate within the substance of the tegmentum cruris and become more or less associated with the cells of the red nucleus of the tegmentum of the opposite side.

The Middle Peduncle of the Cerebellum.

(Processus e cerebello ad pontum.) The fibers of this set arise from the cerebellar cortex, mostly from the middle lobe, and pass forward both in front of and through the substance of the pons, eventually decussating with those of the opposite cerebellar hemisphere in the median line, and entering into intimate relations with the opposite pyramidal tract through

the cells of the nucleus pontum. These middle peduncles form the great medium of connection between the lateral lobes of the cerebellum and the pyramidal motor tracts.

According to the researches of Ferrier, the cross-relations between the peduncular and pyramidal tracts in the pons brings the lateral lobes of the cerebellum in relation with the motor tracts on the same side, owing to the decussation of the pyramidal tracts at the lower aspect of the medulla oblongata.

These anatomical facts are in harmony with the effects of electrical irritation of the cerebellum, by which movements are excited on the same side of the body. The functional relationship to the two sides of the body is therefore *cross* in case of *cerebral hemisphere, direct* in case of the *cerebellar lobes;* thus each cerebral hemisphere acts in combination with the opposite cerebellar lobe.

The Inferior Peduncles of the Cerebellum.

(*Processus e cerebello ad medullam.*) This process connects the cerebellum with the medulla oblongata.

The conclusions of Luciani and Marchi are of interest, bearing upon the origin and tracts of the cerebellar peduncles and their relations to the other nerve-centers. They are as follows:

1. The cerebellar peduncles do not completely decussate, a small band of fibers passing to the optic thalamus on the same side, the principal mass terminating in the red nucleus of the opposite side.

2. The middle cerebellar peduncles are not merely commissural strands from one hemisphere to the other. Many of the fibers enter the pyramidal bundles and end in the gray matter of the same side, while others pass to the gray matter of the opposite side.

3. The inferior cerebellar peduncles send a tract of fibers to the opposite olivary body. They are, in all likelihood, formed of afferent and efferent fibers.

4. The posterior longitudinal bundles and the fillet arise from a common origin in the middle lobe of the cerebellum. They

course with the middle peduncles and come into relation with the nuclei of the cranial nerves, the nuclei pontis, the corpora quadrigemina, and probably the corpus striatum also. At the level of the olive the posterior longitudinal bundles fuse with the fillet, and thus form a connection with the antero-lateral regions and the anterior horn of the spinal cord.

5. The cranial nerves are closely related to the cerebellum through the medium of the fillet and the posterior longitudinal bundles.

6. The origin of the three peduncles is diffused over the cerebellum, but the nucleus dentatum, particularly, furnishes most of the fibers of the superior, the middle lobe of the middle peduncles.

FUNCTIONS OF THE CEREBELLUM.

The cerebellum is an organ of bilateral function, but with mostly a direct action, differing from the cerebral hemispheres, which are also bilateral in function, but with an action mainly crossed. The cerebellum is the organ essential to co-ordination of muscular movements; that is, the function of the cerebellum is that of a relatively independent reinforcing organ to the whole cerebro-spinal system, with a demonstrable sthenic, tonic, static, and trophic action.

Symptoms of Lesions of the Cerebellum.

Limited lesions may run their course without manifesting any symptoms, but when the whole cerebellum has been involved by disease, or has been found greatly or completely atrophied, careful observation has never failed to discover a greater or less degree of awkwardness of movement and instability of equilibrium.

According to Ferrier, the most characteristic symptom of cerebellar disease is an uncertain or reeling gait, like that of alcoholic intoxication. But this symptom, though general and pathognomonic, has not always been obvious, though, as has been proved by *post-mortem* examination, disease of considerable extent has existed in the cerebellum during life.

All lesions sufficiently deep cause ataxia of locomotion; a superficial lesion gives, as a constant and permanent result, trembling of the head and neck. Lesions of the cerebellum also cause trophic changes, but are not accompanied by modifications of the muscular force or alterations of sensibility, general or specific. The most pathognomonic symptom of disease of the cerebellum or its peduncles is a swaying, staggering gait, with a marked tendency to *staggering persistently in one particular direction,* and when there is no motor or sensory paralysis of the extremities and no implication of the cranial nerves. (Gray.) These movements in one particular direction may consist of staggering to one side, or backward or forward, or of a semi-rotary movement around a circle.

According to Ranney, when the middle crura of the cerebellum (those going to the pons) are affected by lesions which create irritation, rotary movements of the body and a lateral deflection of the head and eyes may be developed. As a rule, these rotary movements are toward the healthy side; but this is not invariably the case, as they sometimes are toward the side upon which the lesion is situated. It is a most curious fact that most of the effects of cerebellar lesions are attributed to a greater or less extent to irritation of the crura. Abnormal mental symptoms are, as a rule, absent in cerebellar lesions.

Disturbance of vision, nausea, vomiting, cardiac disturbances, convulsive attacks, hemiplegia, even general paralysis, may occur in connection with cerebellar lesions not due to an actual disturbance of the cerebellar structures, but from pressure upon the nerve-fibers whose functions are related to the parts affected, or pressure upon their nuclei of origin within the floor of the fourth ventricle.

Inco-ordination of movement, an intense vertigo, and a " titubating gait " are the common effects of cerebellar lesions; but these are not in themselves pathognomonic of cerebellar disease, because they may be produced by lesions of other parts of the brain.

The Medulla Oblongata.

The medulla oblongata, or bulb, is but an enlarged part of the spinal cord, somewhat more highly specialized, and, although within the skull, is really spinal, not cerebral, both anatomically and physiologically.

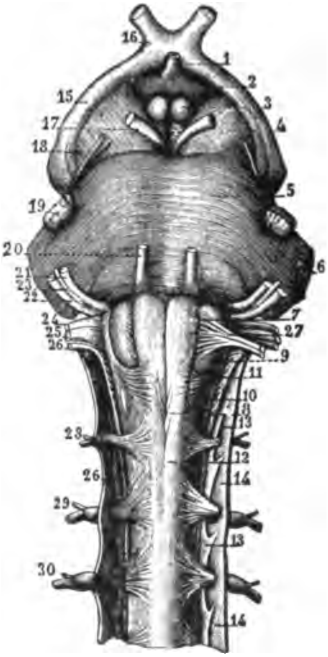

FIG. 24.—ANTERIOR VIEW OF THE MEDULLA OBLONGATA AND PONS VAROLII. (After Sappey.) 1, Infundibulum; 2, tuber cinereum; 3, corpora albicantia; 4, cerebral peduncle; 5, tuber annulare; 6, origin of the middle peduncle of the cerebellum; 7, anterior pyramids of the medulla oblongata; 8, decussation of the anterior pyramids; 9, olivary bodies; 10, restiform bodies; 11, arciform fibers; 12, upper extremity of the spinal cord; 13, ligamentum denticulatum; 14, 14, dura mater of the cord; 15, optic tracts; 16, chiasm of the optic nerves; 17, motor oculi communis; 18, patheticus: 19, fifth nerve; 20, motor oculi externus; 21, facial nerve; 22, auditory nerve; 23, nerve of Wrisberg; 24, glosso-pharyngeal nerve; 25, pneumogastric; 26, spinal accessory; 27, sublingual nerve; 28, 29, 30, cervical nerves.

Its anterior surface rests on the basilar groove of the occipital bone. Its posterior surface is received into the fossa between the hemispheres of the cerebellum, forming the floor of the fourth ventricle; it extends from the upper border of the atlas to the lower border of the pons Varolii, and measures about one and one-fourth inch in length, three-quarters of an inch at its greatest breadth, and one-half inch in thickness.

It is composed of white and gray matter, and in many respects structurally it might be classified with the spinal cord; yet there are to be found within this ganglia numerous collections of gray matter, in addition to well-defined nerve-tracts, which are structurally independent of any relationship to the cord. The medulla is divided into two symmetrical halves by an anterior and a posterior median fissure.

The anterior median fissure, which is a continuation of that of the spinal cord, extends throughout the whole extent of the medulla and terminates at the junction of the medulla with the pons Varolii in a cul-de-sac, the *foramen cæcum.*

The posterior median fissure, which is a continuation of that of the spinal cord, is continued up to about the middle of the medulla, where by its expansion and by the opening up of the central canal of the cord, the *fourth ventricle* is formed. The point of its expansion, or where the posterior median columns diverge, is termed the calamus scriptorius.

Each lateral half is divided by minor grooves into four columns: (1) Anterior pyramid; (2) lateral tract and olivary body; (3) restiform body; (4) posterior pyramid.

The anterior pyramids lie on each side of the anterior median fissure, and are continuous with the pyramidal tracts of the spinal cord. The greater number of fibers which go to make up these columns decussate more or less completely at the lower extremity of the fissure. The greater portion of each pyramid is continuous with the lateral or crossed tract of the opposite side of the cord, while the smaller portion is made up of fibers from the direct pyramidal tract, or the columns of Türck. In some cases, however, the proportion of crossed and direct fibers varies in individual cases; and, as Flechsig has shown, in some rare cases all the fibers decussate, while in others there is no decussation at all, each pyramid passing directly into the columns of the same side.

These observations help to interpret those rare cases in which hemiplegia has occurred upon the same side as the cerebral lesion which caused it.

Of the various columns and tracts, the course of the anterior pyramids is alone clear. They ascend in the same relative position upward through the pons to the crura cerebri. (Ferrier.)

The lateral tract is continuous with part of the lateral column of the cord.

The rest of the anterior and lateral column, or anterior root zones, are thrust out of their original position by the pyramids and disappear beneath and around the *olivary body*, which is a prominent, smooth, olive-shaped eminence, about half an inch long, situated behind the anterior pyramids.

The restiform bodies are the largest columns of the medulla, and are a continuation of the posterior column of the cord. As they ascend they diverge from each other and assist in forming the lateral boundaries of the fourth ventricle. A part of the fibers pass to the corresponding hemisphere of the cerebellum, forming its inferior peduncle, and are known as the *direct cerebellar tract* of the cord; while other fibers are continued on to the cerebrum.

The posterior pyramids are composed of: (1) The columns which are the continuations of the columns of Goll, and, after they diverge at the calamus scriptorius, they are called the *funiculi graciles*, and are increased in size by the addition of a mass of cells, the *clavate nucleus*; (2) immediately external to the funiculi graciles are the columns which are continuous with the columns of Burdach, and are here called the *funiculi cuneati;* these also contain each a special nucleus of gray matter, termed the *cuneate nucleus*.

From the side of the medulla the seventh, eighth, ninth, tenth, eleventh, and twelfth cranial nerves escape, and from the gray matter on the floor of the fourth ventricle are the nuclei of origin of all the cranial nerves above the fourth.

Function of the Medulla Oblongata.

It is the true nerve-center of animal life, since immediate death is apt to follow severe or extensive injury to its structure.

In addition to its action as a conductor of sensory impressions and of motor impulses to and from the brain, it has an automatic reflex action governing all functions which are essential to life; this action depends upon the gray matter located within its substance, and when this gray substance is destroyed, certain important reflex phenomena are instantly abolished.

Respiratory Center.—One of the most important reflex centers located within the medulla oblongata is the *respiratory center.* This center is located at the site of origin of the pneumogastric nerve, near the beak of the calamus scriptorius. This center presides over the movements of respiration. That this is the true center governing the respiratory movement is shown by the fact that so long as the medulla is intact the function of respiration goes on, in an automatic or reflex manner, with the most perfect regularity and rhythm; when the medulla is destroyed, respiration ceases and death ensues.

This center also presides over the acts of laughing, sighing, sobbing, sneezing, and hiccough, acts which are performed by the muscles of respiration.

Cardiac Centers.—There can be scarcely any doubt with regard to the existence of cardiac centers in the medulla, but the situation of these centers has not been exactly determined. These cardiac centers seem to be connected with nerves which have opposite functions, one accelerating, the other inhibiting or restraining the action of the heart.

The inhibitory nerves pass from the medulla to the heart chiefly by means of the pneumogastrics, and sections of these nerves cause an acceleration of the heart's action, because it is no longer restrained by these fibers.

As Ferrier has shown, the inhibitory nerves may be stimulated and the heart restrained or even stopped: (1) By powerful irritation of the sensory nerves of the surface generally; (2) by irritation of the sensory branches of the fifth nerve in the nostril; (3) by irritation of the sensory nerves of the larynx; (4) in particular, by irritation of the *intestinal sensory* nerves. Thus a smart tap on the intestines of the frog causes the heart to stop, a fact which serves to explain the danger of blows on the epigastrium, and the fatal consequences which sometimes follow the sudden shock of large draughts of cold water or irritative poisons on the sensory nerves of the stomach.

The acceleratory nerves of the heart reach that organ through the last cervical and first dorsal ganglia of the sympathetic. From these ganglia they pass to the heart by means of the cardiac nerves. Stimulation of these nerves increases the strength as well as the rate of the heart's action.

Vasomotor Centers.* — The principal vasomotor centers are situated in the medulla, one on either side. They are about one-eighth of an inch long, one-sixteenth of an inch wide, and situated just above the calamus scriptorius. When these centers are destroyed, the reflex vasomotor action is permanently lost. The vasomotor nerves tend to maintain a state of tonic contraction of the arterial walls, and when the vasomotor centers in the medulla which govern these nerves are destroyed, there is a dilatation of the arteries. This "arterial tonus" is controlled, however, in part by the spinal cord, irrespective of the medulla oblongata, by means of subordinate vasomotor centers in the cord; though the subordinate centers in the spinal cord are not able to maintain such a perfect control over the vessels as is effected by the bulbar center.

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* "That there is a vasomotor center, and that it is intra-cranial, we learn by observing, first, that if the medulla is divided immediately below the cerebellum, all the arteries are relaxed, and that a similar effect is produced if certain afferent nerve-fibers which lead to the intra-cranial part of the cord are excited. Its position has been lately determined with great precision in the rabbit by Ludwig and Owsjannikaw, who have found by experiments that it is limited toward the spinal cord by a line four or five millimeters above the *calamus scriptorius*, and extends toward the brain within a millimeter of the *corpora quadrigemina.*"—*Burdon Sanderson*, "*Functions of Vasomotor Nerves.*"

There are numerous other reflex centers situated within the medulla, such as those which influence the glycogenic action of the liver, the secretion of saliva, and the secretion of perspiration.

Lesions of the Medulla Oblongata.

As the medulla is the conducting medium of the sensory and motor tracts to and from the brain, a lesion affecting these fibers would be manifested by anæsthesia and paralysis of motion.

Motor symptoms in the limbs are often bilateral; this would indicate a lesion of both pyramids, or a lesion in the median line of the medulla, so low as to involve the decussation of the crossed pyramidal tracts.

A lesion of one anterior pyramid would cause a paralysis in the opposite arm or leg. According to Gowers, the face, with the exception of the lips, always escapes.

The most characteristic symptoms are those that are due to the interference with the bulbar nerves; namely, the *hypoglossal, glosso-pharyngeal,* and the *spinal accessory,* which cause the affection known as Duchenne's disease.

A lesion affecting the pneumogastric would cause dyspnœa and irregularity of the heart's action.

Aphonia and impairment of the respiratory or circulatory functions are particularly diagnostic of medullary lesions.

According to Ranney, a lesion of the vasomotor center of each side in the medulla would cause a general unilateral redness, abnormal heat, and a profuse sweating on the same side of the body as the lesion.

Diabetes and albuminuria may be excited by lesions of the medulla.

A lesion of the fillet tract causes loss of co-ordination of the upper and lower extremities of the upper and opposite side.

Severe acute lesions of the medulla are quickly fatal by interference with the respiratory and cardiac centers.

The Ventricles of the Brain.

The ventricles are remnants of the original cavity from which the brain was developed. The brain originally is developed from a medullary tube, which becomes constricted in such a way as to form three vesicles; namely, anterior, middle, and posterior.

The anterior vesicle develops into the cerebrum, basal ganglia, and the lateral and third ventricles. The middle vesicle forms the aqueduct of Sylvius and the crura cerebri. The posterior vesicle forms the cerebellum, the medulla oblongata, and the pons Varolii.

There are six ventricles; namely, the two lateral, the third, the fourth, the fifth, and the sixth.

The *lateral ventricles* (which would correspond to the *first* and *second* ventricles) are two large cavities in the substance of the cerebrum, one in each hemisphere, and separated from each other by the septum lucidum, which consist of two laminæ. Each lateral ventricle consists of a central cavity or body, and from the body three cornua extend into the lobes of the brain. The body of the lateral ventricle is of a triangular form. It is bounded above by the under surface of the corpus callosum, which forms the roof of the cavity. Its floor is formed by the corpus striatum, optic thalamus, tænia semicircularis, choroid plexus, and the fornix.

The anterior cornua curves forward and outward into the substance of the frontal lobe.

The middle or descending cornua, the largest of the three, curves around the optic thalamus and extends into the temporo-sphenoidal lobe, nearly to its tip. On its floor is a white eminence of a curved, elongated form, the *hippocampus major*, so called from its resemblance to a ram's horn. This terminates in two or three finger-like processes, and from its resemblance to the paw of an animal is known as the *pes hippocampi*.

The posterior cornua or horn curves backward into the substance of the occipital lobe. On its floor is an eminence similar to that of the middle horn, the *hippocampus minor,* and it also has a digitated extremity, the *pes accessorius.*

The lateral ventricles communicate with each other and with the third ventricle by means of the *foramina of Monroe.*

The *third ventricle* is the narrow space between the optic thalami. Its roof is formed by the velum interpositum; its floor by the lamina cinerea, the tuber cinereum, the infundibulum, and the corpora albicantia. Anteriorly it communicates with the lateral ventricles by means of the foramina of Monroe. Posteriorly it communicates with the fourth ventricle by means of a narrow tubular canal, the *aqueduct of Sylvius.* The third ventricle is crossed by the anterior, middle, and posterior commissures.

The *fourth ventricle* is the diamond-shaped space situated between the medulla oblongata and the pons in front and the cerebellum behind. It may properly be regarded as an expansion of the central canal of the spinal cord. It communicates with the third ventricle above and the central canal of the cord below. It also communicates with the subarachnoidian space by means of the *foramina of Majendie.*

On the floor of the fourth ventricle are several eminences of gray matter. These are the nuclei of origin of the cranial nerves. All of the cranial nerves above the fourth have their deep origin in the gray matter in the floor of the fourth ventricle.

The *fifth ventricle* is situated between the two laminæ of the septum lucidum—the membrane which separates the lateral ventricles.

The *sixth ventricle,* also known as the *central canal,* or the *ventricle of the cord,* is the minute canal which runs through the center of the gray commissure of the cord, and opens above into the fourth ventricle.

The Blood-vessels of the Brain.

The brain and its membranes are more liberally supplied with blood than any other organ, the quantity being computed as one-fifth of the blood of the whole body. The gray matter of the convolutions receives five times the amount that the white matter does. The gray matter needs and uses up far more blood than any other tissue in the body in proportion to its bulk.

The brain receives its blood supply by means of two large trunks upon either side: (1) The internal carotids, which are known as the anterior or carotid set and are distributed to all the important parts of the cerebrum lying anterior to the cerebral peduncles in the region of the base; namely, the frontal lobes, the anterior and outer parts of the temporo-sphenoidal lobes, the island of Reil, the corpus striatum, and the anterior portion of the thalamus. (2) The vertebral, which is called the *posterior* or *vertebral* set. They are distributed to the posterior portion of the cerebrum, the cerebral peduncle, the cerebellum, pons, medulla, corpora quadrigemina, and the posterior part of the thalamus. At the base of the brain these four vessels (the anterior carotids and the vertebrals) form the circle of Willis, thus forming an anastomosis between the two sets of vessels.

The blood supply to the cerebrum may be divided into two systems: 1. The central, or ganglionic system. 2. The cortical system.

The Ganglionic System.—These arteries arise at right angles from the circle of Willis. They supply the basal ganglia. They arise in four groups: (1) The antero-median group, from the anterior communicating and the anterior cerebrals, penetrating the lamina cinerea and supplying the head of the caudate nucleus. (2) The postero-median group, from the posterior communicating and the posterior cerebrals, passing through the posterior perforated space and supplying the walls of the third ventricle. (3) The antero-lateral group on each side from the middle cerebral or Sylvian artery, penetrating the anterior perforated space and supplying the corpora striata and anterior part of the optic thalamus. This is the most important group, as they are the most frequent seat of hemorrhage. The most frequent seat of cerebral apoplexy is the corpus striatum, because that ganglion is extremely friable and very vascular. The optic thalami rank next. (4) The postero-lateral group, from the posterior cerebrals of each side supply the outer and posterior parts of the optic thalami and the corpora quadrigemina and part of the crura cerebri.

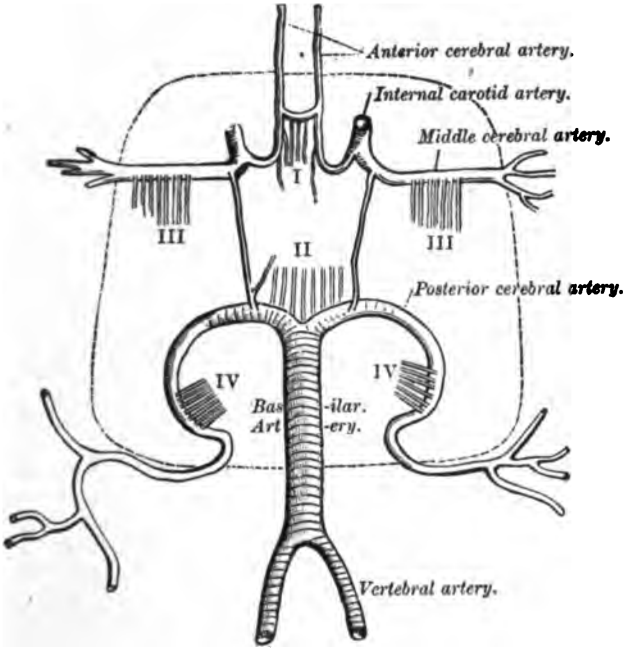

FIG. 25.—DIAGRAM OF THE ARTERIAL CIRCULATION OF THE BASE OF THE BRAIN. (Also see Fig. 25.) I. Antero-median group of ganglionic branches. II. Postero-median group. III. Right and left antero-lateral group. IV. Right and left postero-lateral group. The dotted line shows the limit of the ganglionic circle. (After Charcot.)

The Cortical System.—The arteries which compose this system are the internal carotids and their branches and the posterior cerebral arteries.

The internal carotid gives off the following branches: (1) Ophthalmic; (2) anterior choroid; (3) anterior cerebral; (4) the middle cerebral; (5) the posterior communicating.

The ophthalmic artery passes directly into the orbit and distributes its blood by many branches to the eye and its appendages. This fact enables the neurologist to determine often by means of the ophthalmoscope the condition of the cerebral vessels of the retina. (Ranney.)

The anterior choroid passes backward to the transverse fissure of the brain and assists in supplying the vessels of the choroid plexus.*

The anterior cerebral runs forward and then upward around the anterior extremities of the corpus callosum in the great longitudinal fissure. It supplies the corpus callosum, the convolutions upon the inner surface of the hemisphere as far as the cuneus, the gyrus fornicatus, the quadrate lobe, the upper surface of the frontal lobe, and the paracentral lobule. The anterior cerebral artery is united with its fellow of the opposite side just in front of the chiasm by the anterior communicating artery.

The middle cerebral or Sylvian artery is the largest and most important of the cerebral arteries. It is especially important because it is now known to supply the so called " motor area " of the cerebral cortex. In fact, it may be considered as a direct continuation of the internal carotid. It has four main branches, which run outward and upward and supply the sides and top of the cerebrum. The first of these branches supplies the base of the third frontal convolution (" Broca's convolution "), and any obstruction to this vessel may cause softening of this convolution and aphasia. The second supplies the ascending frontal. The third the ascending parietal; also the paracentral lobule. The fourth supplies the supra-marginal, angular, and first temporal convolutions.

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* The choroid plexuses do not appear to nourish the brain substance or its ganglia, but are destined rather to assist in the secretion of the ventricular fluid. They derive blood from the anterior and posterior choroid vessels.

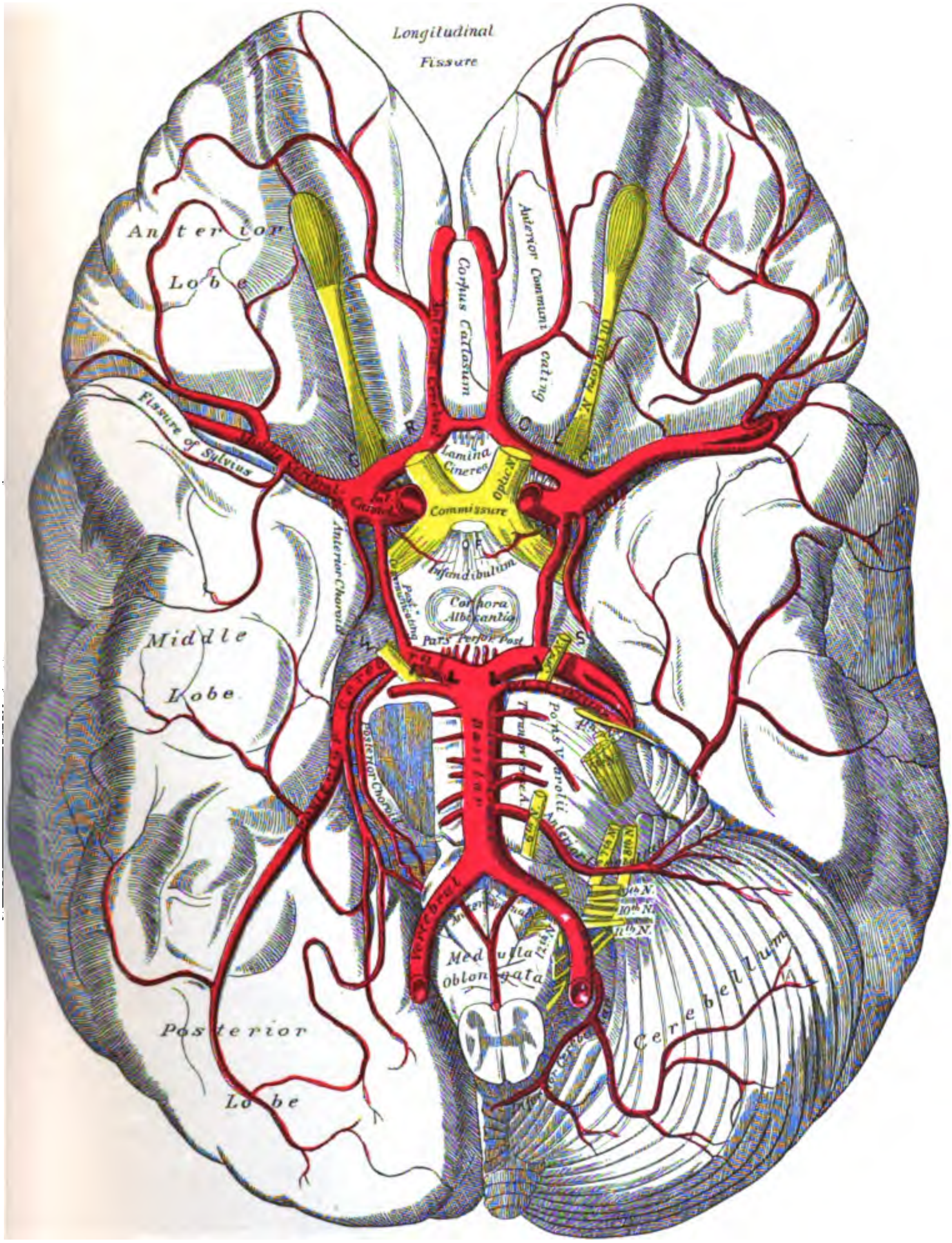

Fig. 26, Plate V.—Base of the Brain.—(After Gray.) Showing the different structures located at the base of the brain, and especially the circle of Willis. The right half of the cerebellum and pons Varolii have been removed.

Embolism or thrombosis of the main trunk causes a hemiplegia of the opposite side of the body and motor aphasia. The middle cerebral artery of the left side is the most common seat of embolism, because that artery is the terminal branch of a direct line of vessels arising from the arch of the aorta in such a way as to favor the entrance of floating particles in the blood into the mouth of the left common carotid artery. The posterior communicating artery connects the internal carotid with the posterior cerebral, and thus helps to form the circle of Willis.

The posterior cerebral arteries, the two terminal branches of the basilar (the basilar artery, so named from its position at the base of the skull, is a single trunk formed by the junction of the two vertebral arteries), pass outward and backward, around the crura cerebri, to reach the temporal and occipital lobes of the cerebrum. Each cerebral artery, after giving off a number of small branches which assist in forming the ganglionic system, divides into three branches: The first supplies only the hook-shaped end of the gyrus hippocampus; the second supplies the fusiform lobule and the neighboring portion of the second temporal convolution; the third supplies the lingual lobule, the cuneus, and the occipital lobe.

These two systems (*i. e.*, central and cortical), although they have a common origin from the same main trunks, are perfectly independent of each other, having no peripheral communication whatever. Their final branches are "terminal arteries."

This accounts for the infarc, or wedge-shaped softening of the brain-substance, when one of them becomes occluded. Each branch nourishes a small convolutional area of its own, and if it becomes obstructed, its area dies for lack of nutrition (as there is no collateral circulation), and softening, slowly or quickly, according to the kind of obstruction, takes place.

As a broad statement, then, we might say that the central or ganglionic system supplies the basal ganglia, and extends up into the white matter of the brain; while the cortical system supplies the cerebral cortex and subcortical region. This leaves a region or zone between the two that is not very well nourished, in which softening is liable to occur, especially in old age, when the nutrition of the brain is impaired.

The cerebellum and pons Varolii receive their blood supply from branches given off from the basilar artery. They are: (*a*) The transverse, which supplies the pons Varolii and adjacent structures; (*b*) the antero-inferior cerebellar, which supplies the under surface of the cerebrum; (*c*) the superior cerebellar, which supplies the upper surface of the cerebellum.

The "*circle of Willis,*" which has been mentioned so often, is the circle which is formed at the base of the brain by the anastomosis between the internal carotid and vertebral arteries. It is formed in front by the anterior cerebral arteries (branches of the internal carotid), which are connected together by the anterior communicating; behind, by the two posterior cerebrals (branches of the basilar), which are connected to the internal carotid by the posterior communicating. It is by this anastomosis that the cerebral circulation is equalized and provision made for effectually carrying it on if one or more of the branches are obliterated. (Gray.)

The Membranes of the Brain.

The brain has three coverings, called, from without inward, the *dura mater*, the *arachnoid*, and the *pia mater*. The *dura mater* is a dense fibrous membrane (composed of two layers) which lines the cranial cavity and is closely attached to the bones at the border of the foramen magnum, but is loosely attached, however, to the convexity of the skull, save at the sutures.

It sends processes or folds inward into the cavity of the skull for the support and protection of the different parts of the brain. One of these passes into the longitudinal fissure and is called the *falx cerebri*. This prevents lateral oscillation of the cerebral hemispheres; another lies between the cerebrum and the cerebellum, and is known as the *tentorium*; this supports the posterior part of the cerebrum and prevents it from injuring the cerebellum by its weight. Another process is situated between the lateral halves of the cerebellum, and is termed the *ralx cerebelli.*

In certain situations the two layers of the dura mater are separated and form what are known as *venous sinuses.* These sinuses are venous channels analogous to veins.

The superior longitudinal sinus occupies the attached margins of the falx cerebri. It communicates freely with the veins of the nose; this fact explains why a congested headache is often relieved by a "nose bleed," and also, as Ranney has pointed out, the liability of patients suffering from facial erysipelas to a complicated meningitis.

The inferior longitudinal sinus is contained in the posterior part of the free margin of the falx cerebri.

The lateral sinuses are formed by the attachment of the tentorium to the skull. They commence at the internal occipital protuberance and pass horizontally outward to the base of the petrous portion of the temporal bone, and then curve downward and terminate in the internal jugular vein.

The straight sinus is formed by the junction of the falx cerebri with the tentorium.

The occipital sinus is attached to the margin of the falx cerebelli.

At the base of the skull are the cavernous sinuses, situated on either side of the sella Turcica. They communicate with each other by means of the *circular* and *transverse* sinuses. Anteriorly they communicate with the ophthalmic veins; posteriorly, with the petrosal sinuses. The petrosal sinuses are: (*a*) The superior, which runs along the superior border of the petrous portion of the temporal bone; (*b*) the inferior, which is situated in the grooves formed by the junction of the basilar process of the occipital with the posterior border of the petrous portion of the temporal bones.

The *arachnoid* is a delicate non-vascular membrane, situated between the dura and pia mater. It does not follow the convolutions of the brain, but passes over them. It covers the exposed portion of the corpus callosum and forms the limiting membrane for the lymph-spaces of the more important vessels of the cranium.

Between the arachnoid and the dura mater is a space called the *subdural* space, and between it and the pia mater is another, known as the *subarachnoidean* space. Both of these spaces are filled with a fluid known as the *cerebro-spinal fluid,* which serves to protect the brain from the effect of concussion, and also to equalize the varying blood-pressure of the brain. The greater part of the fluid of the cranium and of the spinal cord is contained in the subarachnoidean space. This space communicates with the ventricles of the brain, so when there is a greater blood-pressure within the cranial cavity, this fluid is forced downward into the spinal cord; again, when there is a lessened tension of the blood-pressure, the fluid comes upward, and thus equalizes the blood-pressure within the brain.

The *pia mater* is a delicate, fibrous structure, very vascular, seeming to present only a skeleton network of fibers for the support of the vessels going to the nervous substance. This membrane, unlike the preceding, follows the sulci and fissures, closely adapting itself to the convolutions, and is prolonged into the ventricles, where it forms the *choroid plexus* and the *velum interpositum.* From its internal surface small vessels are given off, which pass into the brain-substance. Its blood-vessels are derived chiefly from the internal carotids and vertebral arteries.

The Cranial Nerves.

Following the arrangement of Sömmering, which is the most satisfactory and explicit, the cranial nerves are numbered from before backward, in the order in which they pass out of the skull, making twelve pairs; namely:

1st, or Olfactory.
2d, or Optic.
3d, or Motor Oculi.
4th, or Pathetic.

5th, or Trifacial or Trigeminal.
6th, or Abducens.
7th, or Facial.
8th, or Auditory.
9th, or Glosso-pharyngeal.
10th, or Pneumogastric.
11th, or Spinal Accessory.
12th, or Hypoglossal.

Some of these nerves are nerves of special sensation. They are capable of conveying to the nerve-centers only peculiar impressions, such as odors for the olfactory nerves, light for the optic nerves, and sound for the auditory nerves, and are incapable of transmitting sensation of pain or motor impulses.

Dr. Carmichael (*Medical Century*, February, 1893), in an article on the structure and function of these nerves, says as follows:

"They differ from the ordinary nerve in the material of which they are composed; whereas the common nerve (motor or sensory) is composed of fibers or threads inclosed in a sheath, and possessing a certain amount of sensibility or motor power, as the case may be, these nerves of special sense are constructed of material called 'substantia gelatinosa,' whose specific property is an exquisite sensibility, by which it is enabled to receive impression from infinitesimal and intangible influences, such as the delicious fragrance of the flower, in the case of the olfactory special sense, or the waves of sound in that of hearing; or, more minutely still, the rays of light, in that of the sense of vision.

"Another remarkable peculiarity in the nerves of special sense, and one that distinguishes them from all others, is that they ultimately terminate, and are distributed to nose, eye, ear, etc., by delicate, minutely penciled fibrillæ, each fibrilla connected with its appropriate and congenial neuro-cell, by whose stimulating influence its carrying power to the brain is still further increased.

"There is still another peculiarity belonging to these nerves, and one that especially characterizes them. It is that Nature, whose operations are always guided by salutary and useful purposes, shows the same here in the mode by which the pencillated distribution is made, so that each individual fibrilla may

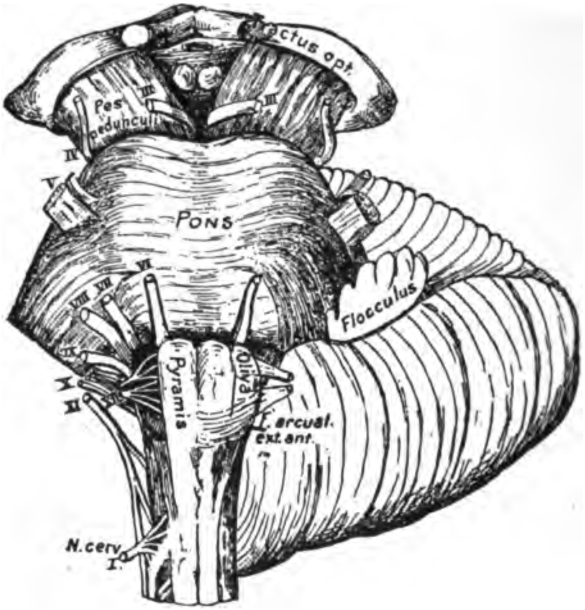

FIG. 27.—TO SHOW THE ORIGIN OF THE CRANIAL NERVES. (After Edinger.) The medulla oblongata, pons, cerebellum, and pedunculus cerebri seen from in front. A front view of the medulla oblongata shows first the thick pyramidal columns ascending from the spinal cord. External to them, imbedded in the prolongations of the lateral columns, are two good-sized enlargements—the olivary bodies. Not far above them the thick masses of fibers which constitute the pons pass across in front of the pyramids. In the prolongation of the line of exit of the anterior roots, between the olivary bodies and the pyramids, the hypoglossal nerve (XII) emerges from the medulla oblongata. The spinal accessory nerve (XI) arises by numerous radicles, which are given off along the side of the cervical cord, and high up in the oblongata, external to the olivary bodies. Above and in line with it emerge the vagus (X) and the glossopharyngeal (IX). Laterally, close behind the fibers of the pons, are given off the auditory (VIII) and the facial nerves (VII). The sixth cranial nerve (VI), the abducens, lies internal to the point of origin of the two last mentioned. The trigeminus (V) arises from the depth of the pons. The pathetic nerve (IV) emerges from the velum medullare posticum behind the corpora quadrigemina. The motor oculi nerve (III) emerges from the front surface of the cerebral peduncles. The olfactory and optic nerves are not shown.

receive and appropriate to itself a single odor or fragrance, or a single quality of sound, or say of color, as respects the three special senses above named."

Other nerves are mixed nerves—that is, nerves transmitting both sensory impressions and motor impulses.

The fifth and ninth, in addition to being nerves of motion and common sensation, are also nerves of special sense—*nerves of taste.*

Still, other nerves are purely motor in their functions; for example, the third nerve.

The cranial nerves have what is called a *superficial* origin, where they are connected with the surface of the brain, and a deep origin, which is their *true* origin, in the substance of the brain.

Olfactory (First Nerve).

This is a nerve of special sense—that is, the special nerve of smell. It arises by three roots. The external white root is long and delicate, passing outward, across the fissure of Sylvius, to the temporo-sphenoidal lobe. The middle or gray root arises from the deeper substance of the frontal lobe. The internal arises from the posterior portion of the frontal lobe.

These three roots converge to form a single cord, which passes forward in a deeper groove on the under surface of the frontal lobe to the ethmoid bone, where it expands into the terminal enlargement, the *olfactory bulb.**

From the olfactory bulb fifteen to eighteen nervous filaments (these, strictly speaking, are the true olfactory nerves) are given off, which pass through the foramina in the cribriform plate of the ethmoid bone; and are distributed to the mucous membrane lining the roof of the nasal cavity, the superior and middle turbinated bones, and the upper third of the septum.

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* Comparative anatomy shows that the olfactory bulbs generally are developed in proportion to the acuteness of smell; also that animals with a very acute sense of smell have a modified arrangement of the turbinated bones, to afford a larger expanse of surface than exists in man. Hunting-dogs recognize odors to which man is absolutely insensible; and certain races of men are said to possess a remarkable delicacy of the sense of smell, and are even capable of distinguishing the different races by the olfactory senses alone.

The olfactory nerves possess none of the general properties of the ordinary nerves belonging to the cerebro-spinal system, being endowed with only the sense of smell. These nerves are not capable of the sensation of pain. No form of irritation of their fibers excite muscular action through other nerves. It is a question, however, if fainting and vomiting cannot be justly regarded as reflex muscular acts, dependent upon the sensation perceived through the olfactory nerves.

For some unexplained reason, mental associations cluster round the sensation of smell more strongly than any other form of impressions received from without. Like the other special senses, olfaction may be cultivated by attention and practice; for example, in the delicate discrimination of wines by experts. Another marked example is where certain employees in our great packing-houses here pass a probe into hams and shoulders as they are drawn past them, to detect any taint in the meat. The rapidity and the accuracy with which they do this is remarkable.

The true olfactory membrane is situated in the upper part of the nasal fossa, and it is necessary that particles come in direct contact with this membrane and be in a gaseous state in order that their odorous properties may be appreciated.

According to Valentin, we can perceive $\frac{1}{1,200,000}$ of a grain of oil of roses. According to Fischer and Penzoldt, one can perceive $\frac{1}{2,760,000,000}$ of a grain of mercaptan.

The bringing of these odorous particles in direct contact with the membrane in the upper part of the nasal cavity is facilitated by a forced inspiration or "sniffing." In ordinary respiration the nose recognizes only pronounced odors, since the filaments of the olfactory nerve are distributed only to the upper third of the lining membrane of its fossæ, and in ordinary breathing the air passes directly through the lower half of these cavities. Hence a modified respiratory effort—a

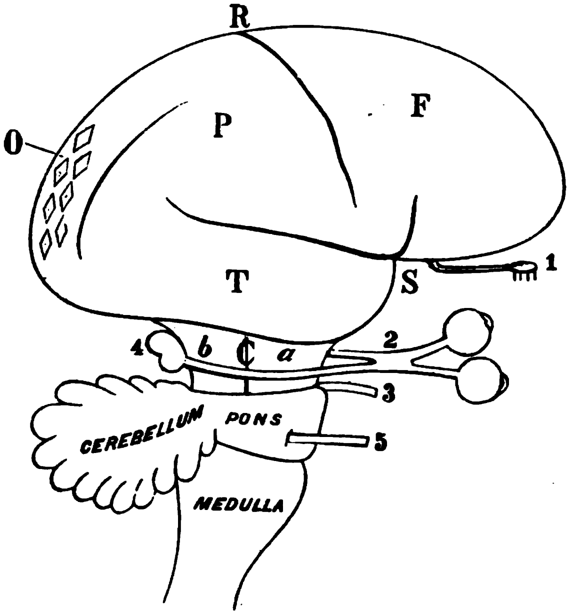


FIG. 28, PLATE VI.—A DIAGRAM DESIGNED TO SHOW SOME OF THE RELATIONS OF THE OPTIC AND OLFACTORY NERVE FIBERS TO SURROUNDING PARTS.—(After Ranney.) *F*, Frontal lobes of cerebrum ; *P*, parietal lobe ; *T*, temporo-sphenoidal lobe ; *S*, fissure of Sylvius ; *R*, fissure of Rolando ; *O*, occipital lobe ; *C*, cerebellum ; *M*, medulla oblongata ; 1, olfactory nerve ; 2, optic chiasm ; 3, motor-oculi ; 4, corpora quadrigemina ; 5, trigeminus nerve ; *a*, basis cruris ; *b*, tegmentum cruris. The diamond-shaped figures in the occipital lobe represent the cortical visual centers of Munk.

quick, forced inspiration or sniff—is usually necessary in order to bring the air carrying odoriferous particles to the olfactory nerve endings. Nevertheless, whenever air mixed with odorous gases and noxious particles is inhaled through the nose during a few successive ordinary respirations, the olfactory sense is awakened to a knowledge of their presence through the law of diffusion of gases, in virtue of which the odorous particles are conveyed to the superior fossa of the nose, and hence to the terminal filaments of the olfactory nerve.

The relations of the sense of smell to taste are very intimate. In the appreciation of delicate shades of flavors it is often hard to distinguish between the two.

According to Gowers, when the olfactory nerves are influenced through the anterior nares, the sensation is termed an "odor"; when through the posterior nares, it is termed a "flavor." In the latter case the sensations are blended with those of taste proper, bitter, sweet, sour, etc., and a mixed sensation is the result.

The common practice of holding the nose when disagreeable substances or remedies are swallowed is an illustration of the connection between these two senses, for this abolishes the disagreeable sensation which is commonly called "taste," but which is, in fact, the smell. (Flint.)

A practical application can be made of this point in the administration of an anæsthetic to those persons who are very sensitive to its effect. By holding the nose and breathing through the mouth for a few breaths they avoid that disagreeable sensation which accompanies the first few whiffs of the anæsthetic. In drinking coffee, wines, etc., and in eating cheese, onions, and the like, we do not *taste* them, but *smell* them.

The olfactory sense is presided over by centers which are situated in the region of the temporo-sphenoidal lobes, including also the uncinate gyrus, hippocampus, and cornu Ammonis. These centers are connected together by means of the so called temporal portion of the anterior commissure of the brain. The two bulbs are connected together by means of the olfactory portion of the commissure; the anterior commissure being made up of these two strands of nerve-fibers.

Diseases and Derangement of the Olfactory Nerve.

Loss of the sense of smell is termed *anosmia.* This may be caused temporarily by an acute catarrhal inflammation of the nares, producing an excessive secretion, which prevents the odorous particles from coming in direct contact with the mucous surface of the nasal cavity. It may be the result of chronic catarrh, causing a dryness of the mucous surface.

Any condition of the nostrils which prevents the free access of air to the upper regions of the nasal cavity may cause loss of smell, without necessarily interfering with the appreciation of flavors, because the physical causes of these latter impressions may still make their way from the back of the mouth and pharynx through the posterior openings of the olfactory chambers, even when obstruction—due to nasal polypi, for instance —may interfere with the act of smelling. (Bastian.)

Loss of smell may also be caused indirectly by paralysis of the fifth nerve and consequent changes in the membrane. The sense of smell is diminished in facial paralysis in consequence of the patient's inability to draw sufficient air into the nostril and direct it toward the olfactory region.

The sense of smell may be impaired or destroyed, on one or both sides, by a destructive lesion involving the bulbs or olfactory tracts, or from destructive lesion of the cortex of the temporal lobe near its apex.

Other causes are: A local meningitis, tumors or abcesses situated in the frontal or anterior part of the parietal region, thrombosis of the carotid artery, providing the thrombosis extends into the middle cerebral, and a lesion affecting the posterior part of the internal capsule.

In rare instances the olfactory nerves are congenitally absent.

Exaltation or perversion of smell is met with quite frequently. Exaltation (hyperosmia) is met with more frequently in hysteria. If met with in the insane, it usually indicates a tumor affecting the anterior parts of the temporo-sphenoidal lobes, or a softening of the olfactory bulbs.

In epilepsy temporary subjective sensations of smell, and in insanity permanent hallucinations of smell, occur quite frequently. Perversion of the sense of smell may accompany many functional disorders. One case of this kind, well known to me, complained that everything he ate " tasted " of gasoline, and he was continually changing his boarding-house; this sensation lasted until the functional trouble from which he was suffering was relieved.

Optic (Second Nerve).

The second or optic nerve is distributed *exclusively* to the eyeball. It is the special nerve of the sense of vision, and has no other function except that of an excito-reflex character. Anatomically, it is divided into three parts:

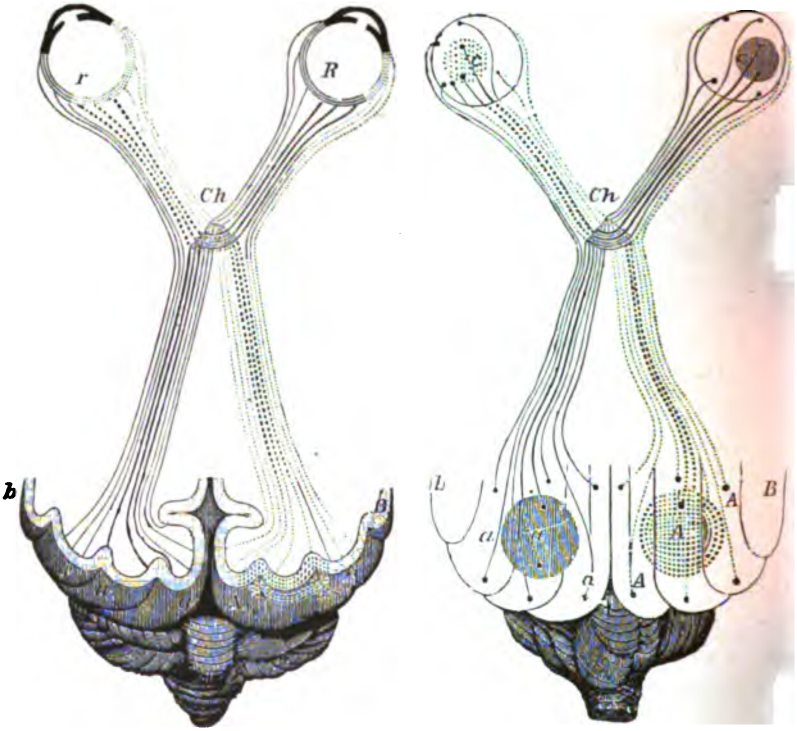
1st. Optic tracts.
2d. Commissure or chiasm.
3d. Optic nerves.

The optic tracts are made up of fibers, which have their origin in the anterior corpora quadrigemina, the pulvinar of each optic thalamus, and the external corpora geniculata; also a few fibers from the lamina cinerea, the tuber cinereum, and the fillet.

These ganglia are called the primary optic centers. From these primary optic centers fibers pass to the cortex of the occipital lobes (chiefly to the cuneus and the upper end of the first occipital gyrus), forming part of the " optic radiation " of Gratiolet. The fibers from the primary optic centers (*i. e.*, from the corpora quadrigemina, corpora geniculata, etc.), after uniting, pass around the under surface of the crura cerebri to the optic commissure. The optic commissure is situated just in front of the corpus cinereum, resting upon the olivary process of the sphenoid bone. It is formed by the junction of the two optic tracts, and from it the two *optic nerves* diverge to pass to their distribution in the retina of either eye.

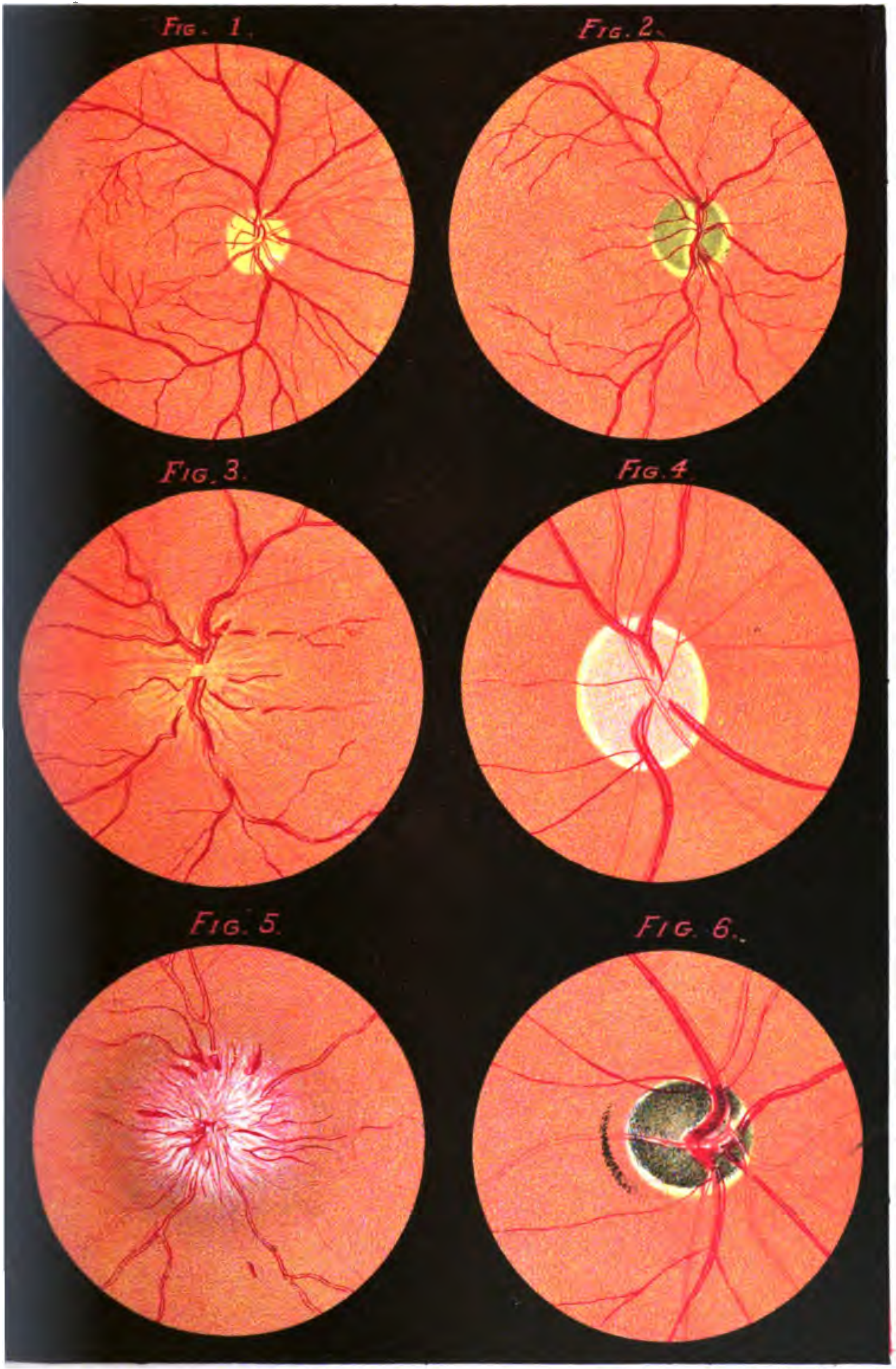
The chiasm is made up of four sets of fibers:

1. The inter-retinal fibers, which are situated in the anterior portion of the chiasm and connect the retina of one eye with that of the other. These fibers have no connection with the optic tracts.



FIGS. 29 AND 30.—THE VISUAL TRACTS. (After Munk.) *A*, visual area of right occipital lobe (dotted); *a*, same of left side (lined); *R*, *r*, retinæ (right and left); *B*, areas of hearing, contiguous to the visual areas; *Ch*, optic chiasm.

2. The inter-cerebral fibers, which are situated at the posterior portion of the chiasm and connect the two hemispheres of the cerebrum. These fibers have their origin in the internal geniculate bodies and are also connected with the posterior corpora quadrigemina. The connection of the optic nerves



H. [illegible], 86-88 Fulton St. N.Y

Fig. 31, Plate VII.—Showing the Fundus of the Eye in its Normal Condition, and its Condition in Various Morbid Affections.

with these bodies probably subserves the relations between visual impressions and ocular movements; that is, by means of these bodies the optic nerves are connected with the oculomotor nerves, and thus reflex movements of the pupils, lids, and eyeballs are brought about.

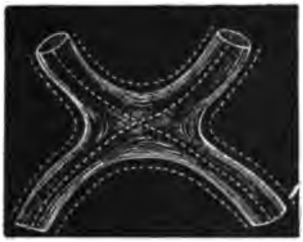


FIG. 32.—DIAGRAM OF THE DECUSSATION OF FIBERS AT THE OPTIC COMMISSURE.

3. The direct fibers, which lie on the external side of each optic tract and connect the outer or temporal half of the retina with the cerebral hemisphere of the same side.

4. The decussating fibers, which pass through the center of the optic chiasm and serve to connect the inner or nasal half of the retina of each eye with the opposite cerebral hemisphere. Thus it will be seen that each retina is connected with the occipital lobe of both hemispheres, and that the outer or temporal half of each retina is connected with the occipital lobe of the same hemisphere, and the inner or nasal half of each retina with the occipital lobe of the opposite side. The decussating fibers are more numerous than those that pass in the tract without decussating.

Why do more fibers cross to the opposite tract than pass to the tract on the same side, if the two sets come from equal retinal areas? Gowers explains this upon the hypothesis that the prominence of the nose shuts off the rays from the peripheral part of the temporal half of the retina, and the power of sight extends but little further than the area habitually stimulated. Hence, while the retinal halves are of equal size,

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the functional area is smaller on the temporal side and fewer nerve-fibers proceed from it.

The *optic nerve* proper arises from the anterior part of the optic commissure, and is distributed exclusively to the retina.

The optic nerve is the only nerve of sight and is absolutely insensible to ordinary impressions. It can be cut, pinched, and cauterized without giving rise to the slightest painful sensation. Any irritation of the optic nerve or its terminal filaments, the retina, produces neither motor nor sensory symptoms, but luminous impressions, as a flash of light; for example, a prick with a sharp instrument, or the passage of a strong galvanic current through the nerve, causes a flash of light; or, again, a blow in the eye will cause a luminous impression, or, as the common saying is, " sees stars."

The optic nerve is capable of carrying impressions which cause reflex muscular movements. Thus light falling upon the retina causes a contraction of the pupil; also too strong a light causes a reflex contraction of the orbicularis palpebrarum muscle.

Lesions of the Optic Nerves and Centers.

A lesion of the optic nerve may be caused by a tumor of the pituitary body (tubercular or syphilitic), an aneurism of the ophthalmic or internal carotid artery, extension of inflammation from meningitis, or from hemorrhage.

Impairment of sight in one eye, without any affection of the other and with loss of action of the pupil, indicates that the lesion is confined to the *optic nerve* proper, and is generally due to sarcomata. When the lesion affects the ***chiasm***, there is temporal hemianopsia, a loss of vision in the ***outer*** half of each retina.

If the lesion be situated within the middle fossa of the cranium, the *optic tracts* may be affected, thus causing homonymous hemianopsia; *i. e.*, where the *temporal* half of one eye and the *nasal* half of the opposite eye are rendered blind.

Any lesion of the brain, if it affects the fibers of the optic

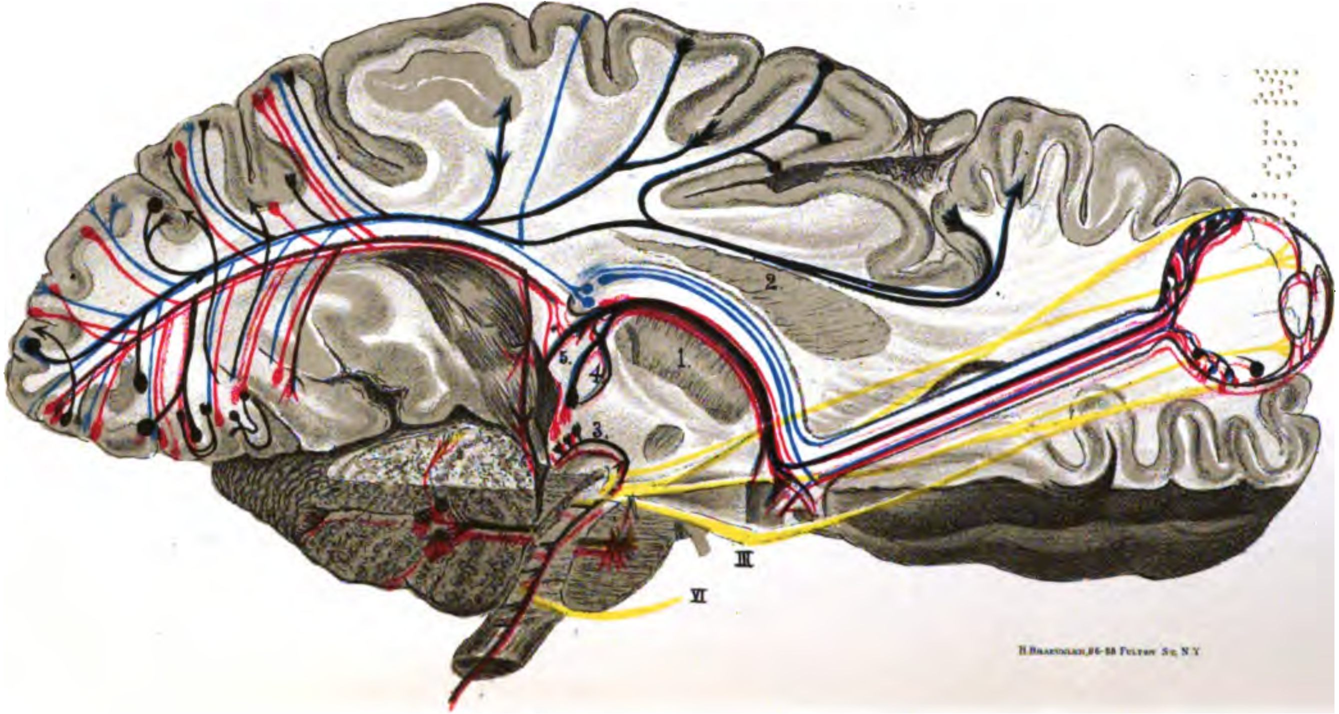

FIG. 33, PLATE VIII.—SHOWING THE COURSE OF THE OPTIC FIBERS FROM THE OCCIPITAL LOBE AND THE CENTRAL GANGLIA THROUGH THE OPTIC TRACT AND NERVE TO THE EYE.

tracts, the pulvinar, Wernicke's* tract, or the cortex of the occipital lobe, will cause hemianopsia; consequently hemianopsia must be regarded as a symptom of a circumscribed lesion of one hemisphere, rather than of a general symptom of brain disease.

Homonymous hemianopsia points strongly to a lesion of the *cuneus*.

There are other symptoms which, taken in connection with hemianopsia, may aid us in locating the sight of the lesion, such as paralysis of certain muscles of the eyeball.

Choked disk is diagnostic of cerebral tumors.

Amblyopia is a partial loss or dimness of vision in which there are no observable lesions. Amaurosis is a total blindness in which there is no observable lesion. These conditions may occur as a result of a toxic condition of the blood, such as uræmic poisoning, lead poisoning, etc.; they are met with also in many cases of hysteria.

Motor Oculi (Third Nerve).

The third cranial nerve is the most important of the motor nerves distributed to the muscles of the eyeball. It supplies all the muscles of the eyeball except the superior oblique and the external rectus, which are supplied by the fourth and sixth respectively. In addition to the above named muscles, it supplies the levator palpebræ superioris, the sphincter iridis, and the ciliary muscle or " muscle of accommodation."

Its apparent origin is from the inner border of the crus cerebri; the deep origin is from a nucleus of gray matter in the floor of the aqueduct of Sylvius. The origin of this pair of nerves lies nearer the median line than any of the other cranial nerves, and they are therefore most readily affected on both sides by a single lesion. This nerve, after passing through the sphenoidal fissure into the orbit, divides into two branches. The superior branch is distributed to the superior rectus muscle of the eye and the levator palpebræ superioris. The inferior branch, the larger, divides into three branches: (1) The internal branch, which is distributed to the internal rectus muscle; (2) the inferior branch, which is distributed to the inferior rectus; (3) the external branch, which is distributed to the inferior oblique. It is this latter branch which supplies the motor power to the *iris*, causing its *contraction*. This nerve is essentially the nerve of accommodation of vision. By its control over the internal muscles of the orbit, the eyes can be moved in unison in their endeavor to focus objects simultaneously upon each retina, and thus to gain a perception of solidity of objects which cannot be afforded by one eye alone. By its control over the ciliary muscle it is enabled to affect the convexity of the crystalline lens, and thus to act as an adjuster of the focal distance of objects whose images fall upon the retina. By its control over the iris and orbicularis palpebrarum muscle it controls the quantity of light admitted to the retina. Thus, when a person comes from darkness into the light, the excessive amount of light falling upon the retina causes a reflex contraction of the orbicularis, followed by a contraction of the pupil of the eye.

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* Wernicke has shown conclusively that a tract of fibers passes from the pulvinar of the optic thalamus to the occipital lobe of the same hemisphere, and that this tract is continuous with the fibers that compose the optic tract. In its course from the optic thalamus to the cortex of the occipital lobe, this tract passes beneath the angular gyrus; consequently, any lesion of this convolution affects visual sense.

Dilatation of the pupils is accomplished by the radiation fibers of the iris, which are under the control of the sympathetic.

Pathetic (Fourth Nerve).

This is the smallest of the cranial nerves. Its function is to supply motor power to the *superior oblique* muscle. Its superficial origin is on the outer side of the crus cerebri, in front of the pons Varolii.

Its deep origin is a nucleus of gray matter in the floor of the aqueduct of Sylvius just below that of the third nerve. From the point of apparent origin the nerve passes forward along the outer wall of the cavernous sinus, below the third nerve and above the ophthalmic branch of the fifth nerve, and enters the orbit through the sphenoidal fissure.

In its function it is purely a motor nerve, but as it passes through the cavernous sinus it receives branches of communication from the ophthalmic branch of the fifth, which is sensory.

Stimulation of this nerve excites contraction of the *superior oblique* muscle only. By the action of this muscle the pupil is directed downward and outward.

Abducens (Sixth Nerve).

This nerve, like the two preceding nerves, is purely motor in its function. It is distributed to but a single muscle—the *external rectus* muscle. Its apparent origin is from a groove between the anterior pyramid of the medulla oblongata and the posterior border of the pons Varolii.

Its deep origin is a nucleus of gray matter in the floor of the fourth ventricle. This nerve passes forward through the cavernous sinus and enters the orbit through the sphenoidal fissure. The origin of the two sixth nerves are near together, and they are, therefore, readily affected on both sides by a single lesion. These nerves are affected with great frequency, because they have a long course, not far apart, over the most prominent part of the pons.

Lesions of the Motor Nerves of the Eye (Third, Fourth, and Sixth).

These muscles being purely motor nerves, a lesion would be manifested by an interference of the motor functions in the form of *paresis* or *paralysis* of the different parts supplied by them. A lesion which destroys the function of the third nerve causes:

1. Ptosis, a condition where the upper eyelid drops down over the pupil and there is an inability to raise it. A slight degree of ptosis may exist, however, and yet there may be no organic lesion.

On this point Ferrier says: " In regard to unilateral ptosis, there is one source of fallacy that may be overlooked. I have observed that in the large majority of persons one eyelid (generally the left) droops over the cornea more than the other, a condition which is greatly intensified by prostration and fatigue, so as in some cases to result in almost complete ptosis. In one case of this kind, well known to me, the drooping of the left eyelid, not obvious in health, occurred to such an extent during a prostrating illness as to lead another physician to suspect a lesion of the third nerve. With returning strength the ptosis disappeared."

2. External or divergent strabismus, owing to paralysis of the internal rectus muscle.

3. Dilatation of the pupil, and consequently a loss of accommodation of vision.

4. Slight protrusion of the ball of the eye, due to a relaxation of the muscles supplied by the third nerve.

5. Diplopia, or double vision.

The movements of the eye have been arranged so that the object seen shall affect the corresponding portions of each retina in order to insure single vision, and for that reason the two eyes will be perceived to move exactly alike—up and down, right or left, simultaneously. When the internal rectus muscle of one eye is called into use, so also is the external rectus of the opposite eye, and *vice versa.* Consequently, when from any cause, the ***internal rectus*** of one eye or the *external rectus* of the opposite eye, or *vice versa,* becomes paretic or paralyzed, the image of an object falls upon two different areas of the retinæ, and the result is that two images of the object are carried to the brain and the person apparently perceives two objects—diplopia, or double vision.

When the muscle which is paralyzed is an abductor, and the eyes therefore converge, the diplopia is simple; when the muscle is an adductor, and the eyes diverge in paralysis, the diplopia is crossed. This depends on the fact that in the former case (of convergent strabismus from loss of abduction), the false image is formed on the side of the retina toward the sound eye, and is, therefore, projected on the other side of the real object. In the case of divergent strabismus from paralysis of an adductor the false image is formed on the side of the retina farthest from the sound eye, and is, therefore, projected on the side of the real object toward the sound eye.

Diplopia is often the first symptom of cerebral disease. It is especially liable to occur from hemorrhage, tumors, or other conditions which are capable of causing pressure in the region of posterior corpora quadrigemina, as these bodies are associated with the co-ordination of ocular movement. Temporary diplopia may occur in connection with functional disease, with toxic diseases, especially diphtheria, and from reflex irritations.*

Gowers speaks of a form of palsy of the third nerve which occurs chiefly in the subjects of syphilis and presents a peculiar tendency to relapse. One third nerve becomes paralyzed, improves under treatment, and then, perhaps while the treatment is being continued, the other third nerve suffers, and afterward the affection of the first returns. The nature of the lesion in these cases is uncertain.

Paralysis of the fourth nerve is a rare affection and not always easily detected. When this nerve is paralyzed, the eyeball is immovable, as far as rotation is concerned. When the head is moved from side to side, the eye does not rotate to maintain the globe in the same relative position, and consequently there is diplopia, or double vision.

Paralysis of the sixth nerve is the most frequent of eye palsies, and occurs especially often in syphilis and in locomotor ataxia. Paralysis of this nerve causes convergent strabismus and double vision.

When the external rectus muscle is paralyzed, objects appear larger than normal. When the internal rectus muscle is paralyzed, objects appear smaller than normal. These conditions are due to interference of the visual angle.*

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* Diplopia occurring in connection with intense vertigo, dilatation of the pupils, and muscular twitchings is indicative of hemorrhage into or in the region of the corpora quadrigemina.

Causes of Paralysis of the Ocular Muscles.—1. Injuries, especially at the orbital fissure or in the orbit, but sometimes at the origin of the nerves. 2. Neuritis. This neuritis may be: (*a*) simple neuritis, the result of cold and exposure or an extension of the inflammation from the surrounding structures, as a cellulitis or a meningitis; (*b*) syphilitic neuritis. 3. A state of blood-poisoning from diphtheria and other low forms of toxic diseases. 4. Hemorrhage into the sheath of the nerve, compressing its fibers. 5. Tumors, especially syphilitic gumma.

Spasms of the Ocular Muscles.—This condition is due to an irritative lesion which is not sufficiently destructive to cause paralysis. It may be due: 1. To a lesion in the pons. 2. Disease of the base of the brain, especially meningitis. 3. Hysteria. In this affection the eyes never *diverge* as they do in organic disease, but are usually directed either upward and to one side or they are directed inward in strong convergence. (Gowers.)

Convergent strabismus is frequently associated with *hypermetropia,* and on rare occasions with *myopia.* Temporary convergent strabismus occurs, especially in children, quite frequently from gastric irritation.

Conjugate deviation of the eyes is a condition in which both eyes turn strongly to one or the other side.

Nystagmus.—This is a condition in which there are involuntary rhythmical movements of the eyeball. This movement may be horizontal or rotary. The rhythm is usually regular. The spasm is of a clonic nature, affecting the external ocular muscles. It is met with in inflammatory and degenerative changes of the structures of the eye, and also in various nervous affections.

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* There is one other condition which will cause objects to appear larger or smaller than normal—inflammation of the choroid coat. In the effusive form of choroiditis objects appear smaller than normal; while in the cicatricial form of choroiditis objects appear magnified. This is attributed to a separation in the one case and to an aggregation in the other of the cones of the retina. The eye by constant use has become enabled to partly estimate the size of objects by the number of cones in the retina which are covered by the image of the object; thus, from either of these causes, the objects appear larger or smaller, as the case may be. (Ranney.)

Nystagmus may also, at times, occur as a temporary condition, resulting from some peripheral irritation.

The differential diagnosis between paralysis of the various ocular muscles is best studied by reference to the following table, as given by Bastian.

SIGNS AND SYMPTOMS.	INTERNAL RECTUS.	EXTERNAL RECTUS.	INFERIOR OBLIQUE.
Appearance and Movements of Affected Eye.	Deviation of eye outward. Movements inward defective, often not beyond median line.	Deviation of eye inward. Movements outward defective, often not beyond middle line.	Slight deviation downward and inward. Slight defective mobility, most marked in direction upward and inward.
Secondary Deviation of Sound Eye.	Outward.	Inward, and well marked.	Upward and somewhat outward.
Relative Position of Double Images.	Side by side, parallel, and crossed—the false image being on the healthy side. Separation of images increasing with movements of object toward sound side. Diminution of distance and ultimately single vision, with movements of objects toward affected side.	Side by side, parallel and harmonious—the false image being on the affected side. Separation of images increasing with movements of eye outward. Diminution and ultimately single vision with movements inward.	One above the other; the false image above and tilted toward the affected side. Vertical distance of images increases as object is moved inward; inclination to one another increases with rotation outward. Single vision, with eyes directed downward.
False Projection of Visual Field.	Inward.	Outward.	Upward and somewhat outward—confixation in the median line.
Vertigo.		Often well marked.	
Attitude assumed for Mitigation of Double Vision.	Head turns toward healthy side.	Head turns toward the affected side.	Head thrown backward and chin turned slightly toward the healthy side (so as to bring the lower and outer segments of the field of vision chiefly into use).
Effects of Secondary Contracture of Antagonistic Muscles.	Double images extend into the outer half of the visual field.	Double images extend inward, and may affect the whole field of vision.	Double images extend into lower half of the visual field.
Association with other Paralyses.	Rare as an isolated affection; commonly as part of a general paralysis of the third nerve.	Separately, or in association with that of superior oblique. More rarely bilateral.	Rare as an isolated affection; and when co-existing with paralysis of other muscles supplied by the third nerve, its distinct diagnosis becomes impossible—ptosis masking many of above signs.

SIGNS AND SYMPTOMS.	SUPERIOR RECTUS.	INFERIOR RECTUS.	SUPERIOR OBLIQUE.
Appearance and Movements of the Affected Eye.	Deviation slightly downward; cornea diverges a little outward from action of inferior oblique. Upward movements defective.	Deviation slightly upward; and cornea turned a little outward owing to action of superior oblique. Downward movements defective.	Slight deviation of eye inward and upward on lowering the object; and simply upward when it is moved far toward the healthy side. Slight defective mobility, chiefly downward and inward.
Secondary Deviation of Sound Eye.	Upward and somewhat outward.	Downward and somewhat outward.	Straight downward, and generally well marked.
Relative Position of Double Images.	In upper half of visual field; images one above the other; the false image above and tilted toward sound side. Separation increasing with elevation of point of fixation; and diminishing to single vision with depression of visual axis to horizontal line.	In lower half of visual field; images one above the other; false image below and tilted toward the affected side. Separation increases as axis of vision is directed more downward; distance diminishing to single vision, with elevation of visual axis.	In lower half of visual field; one below the other; false image below and tilted away from affected side. Vertical distance greatest when looking downward and inward. Inclination greatest when looking downward and outward. (Image of affected eye seems nearer than that of sound eye.) Single vision with eyes directed upward.
False Projection of Visual Fields.	Upward.	Downward.	Downward and slightly outward.
Vertigo.	Rare; felt principally on ascending ladder or stairs.	Very marked in all cases where line of vision has to be lowered, as when walking, ascending stairs, and during all kinds of handiwork.	Often well marked,
Attitude Assumed for Mitigation of Double Vision.	Head and field of vision depressed.	Head inclined forward.	Head inclined forward and turned toward healthy side (the affected eye being rotated toward the chin), so that objects are brought into the upper and outer part of the field of vision.
Effects of Secondary Contracture of Antagonistic Muscle.	Double images extend into the lower half of the field of vision.	Double images extend into the upper half of the field of vision.	Double images extend into the upper part of the field of vision.
Association with other Paralyses.	Sometimes associated with ptosis, or may exist alone.	Mostly as part of a general paralysis of the third nerve.	Separately or in conjunction with the external rectus.

Trigeminal (Fifth Nerve).

The fifth or trigeminal nerve is the most important nerve of common sensibility in the body; also it is the largest cranial nerve, and resembles a spinal nerve in that it arises by two roots—an anterior or motor, which is the smaller, and a pos-

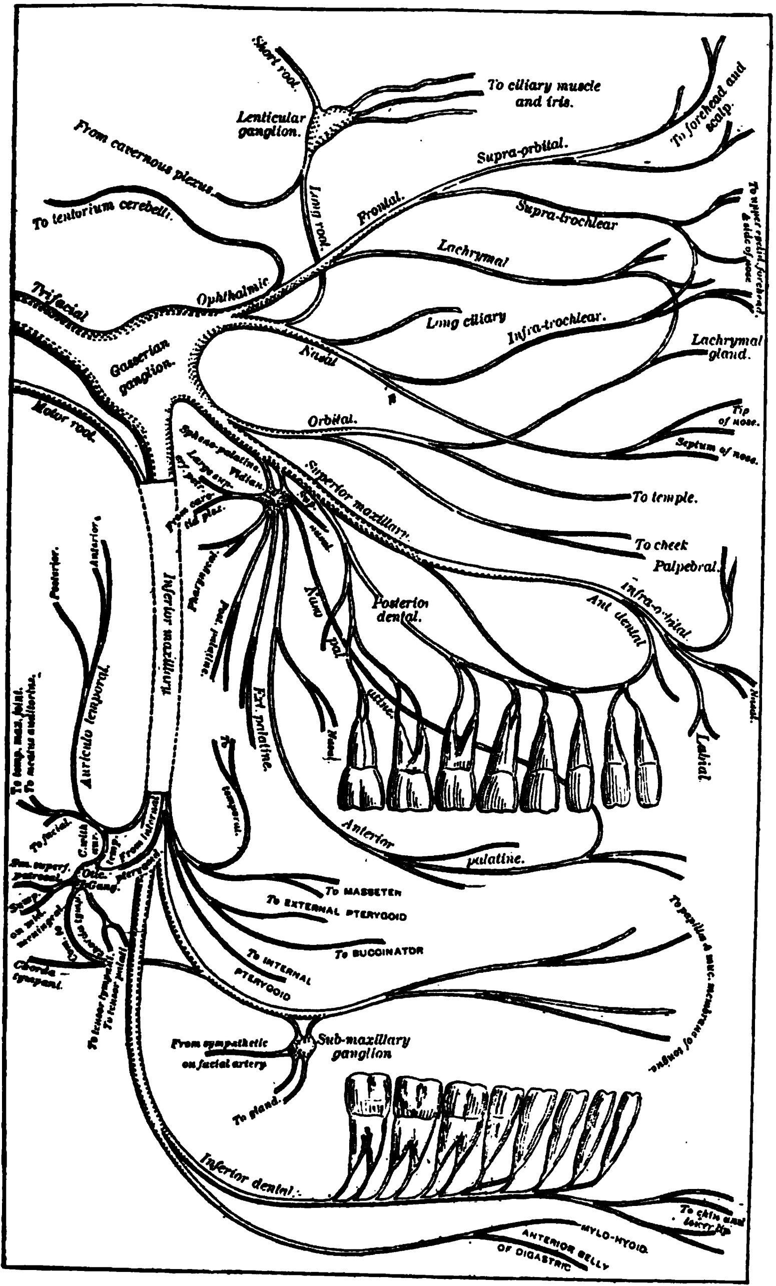

FIG. 34.—DIAGRAM OF THE DISTRIBUTION OF THE FIFTH NERVE. (Gray, after Flower.)

terior or sensory, which is the larger, and has a ganglion developed upon it.

Its apparent origin is from the lateral portion of the pons Varolii. Its deep origin is very extensive, reaching from the level of the anterior quadrigeminal tubercle to the lowest part of the medulla, but chiefly from the gray tubercle of Rolando. This nerve represents the sensory roots of all the cranial nerves from the third to the twelfth. This fact enables us to understand why pains radiate from one nerve tract to another.

The origins of the two fifth nerves are the farthest apart of all the cranial nerves, and therefore are least frequently injured together by a single basal lesion. The two roots of the fifth nerve pass forward, side by side, as far as the petrous portion of the temporal bone. At this point there is developed on the sensory root a large semi-lunar ganglion, termed the *Gasserian ganglion*. The sensory or larger division of the fifth divides into three branches: 1. The *ophthalmic*, which escapes from the cranium through the sphenoidal fissure, and is distributed to the eyeball and the integument and muscles of the forehead and upper eyelid; 2. The *superior maxillary*, which passes out through the foramen rotundum, and is distributed to the teeth and gums, to the upper jaw, the sides of the nose, the lower eyelid, the upper part of the face, and the upper lip; 3. The *inferior maxillary*, which passes through the foramen ovale, and is distributed to the teeth and gums of the lower jaw, the integument of the temple and external ear, lower part of the face and lower lip, and the muscles of mastication—the two pterygoids, the temporal, masseter, mylo-hyoid and anterior belly of the digastric.

The two first divisions consist exclusively of fibers derived from the larger root and ganglion, and are solely nerves of *common sensation*.

The third division is composed of fibers from both roots, and is therefore a nerve *both* of motion and sensation; it also contains a large branch, which is distributed to the tongue—the nerve of common sensation of the tongue and the special nerve of taste to the anterior two-thirds of the tongue. The motor division of the fifth does not enter the Gasserian ganglion, but passes beneath it and accompanies the inferior maxillary nerve until it escapes from the cranial cavity. Within the cranium the two roots are distinct; but after the small root passes through the foramen, it is united by a mutual interlacement of fibers with the sensory branch.

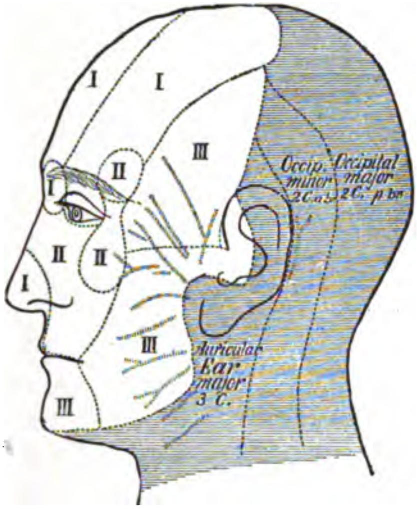

FIG. 35.—SHOWING THE DISTRIBUTION OF THE SENSORY NERVES OF THE FACE. (After Dana.) I, II, III, First, second, and third branches of the fifth. The shaded part is supplied by the cervical nerves; 2C, *a. br.*, second cervical anterior branch (the lesser occipital nerve); 2C, *p. br.*, second cervical posterior branch (the greater occipital nerve).

Causes of Lesions of the Fifth Nerve.—Hemorrhage; softening or tumors within the pons; tumors at the base of the brain or in the wall of the cavernous sinuses; meningetis; neuritis; inflammation extending from the bony orifices through which the nerve passes; wounds, especially puncture and bullet wounds; tumors of the middle fossa of the skull or of the base of the brain; tumors in the region of the Gasserian ganglion; aneurism of the internal carotid artery; exposure to cold and dampness; bony exostoses, especially of the upper and lower jaw.

Symptoms of Lesions of the Fifth Nerve.—The varied functions of the different nerve-fibers—motor, sensory, and sympathetic—which make up the nerve as a whole may be affected. There may occur spasm of the facial muscles, pallor or redness and even swelling of the face, increased lachrymation, salivation, herpes, changes in the hair, whilst hyperæsthesia may sometimes be temporarily present. Complete division of the fifth nerve causes loss of sensibility of the integument of the face and head. The conjunctiva can be touched by blunt or sharp instruments without causing reflex movements or lachrymation. The sense of temperature is completely absent; neither intense cold, as caused by the application of ice, nor heat, causes the least sensation. The muscles of mastication are palsied; also there is loss of general sensibility and the sense of taste in the anterior portion of the tongue. The reflex phenomena of deglutition are interfered with. The secretions of the lachrymal, parotid, and submaxillary glands are rendered deficient. The secretion of the buccal mucus may be so excessive as to oblige the patient to have a pocket handkerchief constantly applied to the mouth in order to prevent the liquid from running down the chin.

The after-effects of division of the fifth nerve are inflammation, cloudiness, and, later, ulceration of the cornea.* The ulceration may perforate the cornea and cause loss of the eye by panophthalmitis. The mucous membrane of the nose, buccal cavity, and lips becomes congested, inflamed, and disorganized, and breaks down and forms ulcers; those ulcers heal with difficulty; the gums become spongy.

Anæsthesia of the parts supplied by the fifth nerve and no motor symptoms indicate a peripheral lesion. Anæsthesia of the face and paralysis of other cranial nerves indicate a lesion at the base of the brain.

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* This ulceration is commonly supposed to be due, in accordance with Meissner's view, to the inflammation of a set of "trophic fibers" which proceed from the Gasserian ganglion with the ophthalmic division of the fifth nerve, and not to the mere loss of sensibility in the conjunctiva and cornea, exposing them unduly to the influences of irritants from without. (Bastian.)

If the muscles of mastication are paralyzed and no anæsthesia exists the lesion is outside of the cranium and is confined to the motor root or to the inferior maxillary branch of the nerve.

If a lesion is situated back of the Gasserian ganglion, there will be no trophic, vaso-motor, or secretory troubles, for the special fibers which govern these functions have their origin in the Gasserian ganglion and pass by means of the fifth nerve to the parts which they supply. Paralysis of the fifth nerve and of the arm and leg on the opposite side indicates a lesion in the pons or medulla. If the face and limbs are rendered anæsthetic on the same side, the lesion is above the pons. Herpes zoster in the region supplied by the fifth nerve indicates an irritative lesion in the region of the Gasserian ganglion or of the nerve-trunk in front of it. Glaucoma (due to increased secretion of the aqueous humor) may result from irritating lesions of the fifth nerve. Donders first called attention to the fact that this condition appeared to be due to irritation of the secretory fibers contained in the trigeminus. If the lesion is only sufficient to cause irritation, there will be neuralgia instead of anæsthesia.

Diseases of the Fifth Cranial Nerve.

Spasm of the Fifth Nerve.—Irritative lesions of the motor division of the fifth nerve may cause spasm of the masseter, temporal, and pterygoid muscles. The irritative lesion may be the result of apoplexy, cerebral softening, or meningeal exudation. The spasm may be due to reflex irritation, as, for instance, injury to the palm of the hand, but more especially the sole of the foot. These spasms may be: (*a*) tonic, as in tetanus or lockjaw, in which case the jaw is rendered immovable, or may produce a grinding of the teeth; (*b*) clonic, in which there is a chattering of the teeth as in a chill. Tonic spasms are usually bilateral.

Paræsthesia.—Trigeminal paræsthesia is an affection in which there is a peculiar numbness, pricking, or formication in the course of the fifth nerve. This affection is met with more frequently in anæmic, nervous, and hysterical persons, and may be nearly constant and prove very annoying. Paralysis of the fifth nerve most frequently results from lesions within the pons, disease at the base of the brain (especially tumors), chronic meningitis, and caries of the bone. This condition may also be caused by traumatic injuries, such as punctured or bullet wounds through the mouth and nose. However, the most common affection of the fifth nerve is neuralgia—*trigeminal* neuralgia.

Neuralgia of the Fifth Nerve (Trigeminal Neuralgia).

The fifth nerve is more frequently the seat of neuralgia than any other nerve in the body. The pain may manifest itself in either of the three branches of the fifth pair or in all three branches simultaneously; but more commonly occupies one or two of the divisions than all three.

The pain is usually limited to certain well-defined spots, of extreme sensitiveness to pressure, termed "*puncta dolorosa.*"

The painful points in the first or ophthalmic division are: (1) The supra-orbital, at or a little above the supra-orbital foramen; (2) the palpebral, in the upper eyelid; (3) the nasal, at the junction of the nasal bone with the cartilage; (4) the ocular, within the eyeball.

In the second division of the fifth, the painful points are: (1) An infra-orbital, at the emergence of the nerve beneath the orbit; (2) a nasal, at the side of the nose; (3) a malar, over the most prominent part of that bone; (4) a superior labial, in the upper lip ; and (5) the palatine.

When the third or infra-maxillary division is affected, the pain is not confined to well-defined points as in the first and second divisions, but extends over a large area, including the parietal eminence, the temple, the ear, the lower jaw, and the tongue; but the chief points are: (1) The temporal; (2) the inferior dental.

There are two types of neuralgia of the fifth nerve: A mild one, termed *simple neuralgia;* a severe one, termed *tic douloureux.*

The first variety, *simple neuralgia,* may result from exposure to cold and dampness, or may be due to any of the causes which operate to cause neuralgia in any other part of the body, such as anæmia, malaria, rheumatism, syphilis, etc. Many cases of neuralgia are due to reflex irritation, the teeth in particular being very commonly at fault; next in frequency stand errors of refraction. Diseases of the nasal and frontal sinuses, but more especially of the turbinated bones, may cause severe and intractable forms of neuralgia.

Dr. Collier (*The Lancet,* October, 1895) cites two cases of severe and persistent facial neuralgia that had defied all treatment, which, upon examination of the nasal cavities, revealed extensive disease of the middle turbinated bone, the removal of which resulted in almost immediate as well as permanent and complete cure.

This form of neuralgia occurs most frequently in the first half of life; most attacks occur in the winter and spring.

Symptoms.—If the affection is confined to the first division, the pain radiates from the supra-orbital notch over the fore part of the head, and may extend as low down as the eyelid and side of the nose. When the second division is affected, the pain is limited to the upper jaw, the cheek, and the side of the nose. When the third division is affected, the pain extends over a larger area than when the second division is affected. The pain may be felt in the lower jaw, the tongue, the ear, the parietal eminence, and the temple.

The pains of trigeminal neuralgia may vary from a mild ache, coming on at certain irregular times, to a severe and shock-like pain. Usually they come on suddenly, are sharp and intense, with exacerbations and remissions. The pain often lasts for days without entirely ceasing. The pains follow the course of the nerve affected. The pains may begin in one branch and radiate to the other branches. The characteristic of neuralgia is that the pain increases in intensity until the paroxysm reaches its height.

The second type of neuralgia, *tic douloureux*, is usually due to organic lesions within the pons or at the base of the brain; but many cases occur without any apparent cause. It is almost entirely confined to advanced age, and is brought on or made worse by the least movement of the face. The symptoms of tic douloureux are of the most distressing character. The pains are of a violent, burning, piercing, or shooting character. The pains come at first in paroxysms of great severity, so that the patient holds his face and sits in mute agony. Later on the pains gradually become more or less constant. This form of neuralgia may continue for years. The pains are worse in winter and often become less or cease during summer. Ocasionally they come on for a few months every year, usually during the spring.

Aconite.—Aconite is especially useful in those acute congestive neuralgias, the result of " catching cold " or after geting wet. The face is hot and red, or pale; pulse full and strong or small and quick; a burning, pressive, stupefying headache: excessive restlessness, great anguish, rolling about screaming: burning thirst; a chilly, creeping sensation, alternating with flashes of heat; the pain is violent and throbbing, or sharp, shooting pain, which follows the course of the nerve; numbness and tingling of the affected parts; toothache, even in the sound teeth; sensation as if the tooth would be shattered to pieces; excessive soreness and sensitiveness of the tooth. A drop of the tincture or a few drops of the 1x or 2x dilution in half a tumbler of water; a teaspoonful of this twenty or thirty minutes apart for a few doses will often scatter the pain as if by magic.

Actea rac.—Reflex neuralgia, the result of ovarian irritation; rheumatic facial neuralgia, especially where the tendonous structures are involved; neuralgia affecting the malar bone, pain goes off at night, reappearing next day; ciliary neuralgia; sharp, shooting pains from the occiput through the eye, or darting from the eye to the top of the head, with redness of the eyes and photophobia; eyeballs feel enlarged; pain in the center of the eyeballs, and also a sensation as if the pain were situated between the eyeball and the orbital plate of the parietal bone; pains so severe, especially at night, as to almost drive one crazy. During the paroxysm, an unpleasant sour taste in the mouth.

Agnus castus.—Infra-orbital neuralgia of the left side; the pain is of a pressive, tensive character, or like a blow, and is relieved by hard pressure.

Agaricus.—The neuralgic prosopalgia of agaricus is electric-like, as of splinters between the skin and flesh, mostly in the infra-orbital nerves and along the jaws; tearing in the face and jaw-bones; twitching of the facial muscles; face pale, puffy; blue rings under the eyes; nose and lips bluish; herpetic eruptions, principally on the upper lip.

Argentum nit.—Pains of a sudden, rending character extending into the orbit; the eyeball feels as though it would be pressed out; one-sided, dull, drawing pains, spreading from the right temple to the upper jaw and through the dental arches, often mistaken for toothache.

Arsenicum alb.—The pain is chiefly burning or stinging, as from a number of red-hot needles; pains darting quickly from place to place. The pains usually affect one side of the face, and seem to be almost maddening, driving the patient from place to place; at the height of the attack there is nausea and vomiting; neuralgia of the teeth; burning, tearing pain; pains relieved by warmth; teeth feel long and very sore.

Baehr says: " No medicine relieves more surely than arsenic a toothache which reaches its climax about midnight or immediately after lying down, and becomes so intense that the patients are unable to describe it; who, tormented by anxiety and restlessness, run about, uttering moans and groans. Sleep sometimes sets in after the patients have taken a single dose of the remedy, which sometimes acts with such magic effect that they vow they have been given a dose of laudanum. If the cheek is swollen, the remedy has no effect."

Arsenicum is especially called for in those cases where the face is pale and sunken and there is a puffiness around the eyes; also in malarial neuralgia where attacks occur periodically.

Belladonna.—Facial neuralgia, with flushed face, injected eyes, lachrymation, great nervousness and restlessness; shooting, tearing pains from the side of the face up into the temple and ear, and down into the nape of the neck, which becomes rigid; pains mostly right-sided; violent neuralgia, sometimes originating in the right temple and spreading over the orbit to the right cheek, worse from the slightest motion; sometimes the pain radiates from the orbit to the forehead, sometimes affecting the ears and teeth; pains get gradually intolerable and then cease suddenly; pains break out in paroxysms, are worse toward evening, are aggravated by contact, by cold air, and from eating; relieved by the application of cold water and by complete rest; sometimes relieved by hard pressure.

Bryonia.—General facial neuralgia, or tic douloureux, the pains of a sharp, darting, stitching character, and extending to the teeth; or a pressing, tearing, shooting pain, as from subcutaneous ulcerations; pains aggravated by stooping, noise, light, and moving the jaws; better from hard pressure and from cold applications. Neuralgia affecting chiefly the left side.

Calcarea.—Neuralgia confined chiefly to the teeth; toothache during pregnancy, with determination of blood to the head, from taking cold; worse at night; aggravated by noise and worse from warmth or cold.

Cedron.—Cedron is an invaluable remedy in neuralgiform affections when the pains involve the supra-orbital nerve and the eye and are worse on the left side; the eye burns as if it were on fire. Neuralgia returning at precisely the same hour each day. Cedron is especially valuable in malarial neuralgia when the attacks return with clock-like regularity.

Chamomilla.—Neuralgia of the face; lancinating or tensive or drawing pains, or a tearing pain which darts into the ear; face puffy, swollen; heat and redness of one cheek; profuse secretion of saliva; twitching of the eyelids, lips, and facial muscles; excessive sensitiveness to pain; ill-humored, easily angered; pains worse at night and from warmth, also from eating and drinking. In toothache the pain is not located in any particular tooth; the teeth feel as if loose and elongated.

China.—China is especially suited to neuralgia of the infra-orbital nerve on either side when the symptoms are typical in their return, and when the slightest draught of cold air makes the patient worse, especially useful if the neuralgia is of malarial origin.

Clematis.—Violent toothache in the back teeth, transiently relieved by holding cold water in the mouth or drawing in cold air, and greatly aggravated at night on lying down, from warmth of bed, and from tobacco; with the toothache there is often free salivation and soreness of the gums; teeth feel too long.

Dulcamara.—Facial neuralgia, seemingly starting from the malar bone, paroxysms preceded by the parts becoming cold, attended with canine hunger. Facial neuralgia caused by going out in the wet; the pains aggravated from the slightest exposure to cold, better from external warmth.

Gelsemium.—Neuralgia of the face, pains generally sudden, sharp, darting, and shooting; pains following along one of the divisions of the fifth nerve at a time; associated with the pains there is contraction and twitching of the muscles supplied by the affected nerve; the face is usually congested and of a dusky hue; there is usually vertigo, occipital headache, and dimness of vision. The neuralgia is usually intermitting in its type. The seventh pair of nerves also are involved, and the patient makes all sorts of grimaces.

Ignatia.—This remedy is indicated in supra-orbital neuralgia of the left side, especially when it is of a hysterical character, or excited by grief or fright. Intermittent neuralgia.

Iris vers.—Violent shooting, cutting pains in the temporal region, extending into the eyes and teeth; violent pains over the eye, in the supra-orbital region, on either side, but only on one side at a time. Neuralgia begins every morning after breakfast, involving one or other branches of the fifth nerve.

Neuralgia attended with a distressing vomiting of a sweetish mucus, and occasionally, when much straining, with a trace of bile. This remedy is specially indicated if the pain is seated over the left superciliary ridge, or is accompanied by nausea or conjunctival redness.

Kalmia latifolia.—Sharp rending or stinging pains in one or all the branches of the fifth pair of nerves and extending into the neck, temples, and teeth; burning, sharp, shooting, and twitching pains, commencing in the neck and going to the top of the head, then to the temples and right side of the face. Neuralgia each afternoon, becoming worse at night. Supra-orbital neuralgia, worse on the right side; parts tender to touch. Facial neuralgia, involving the teeth of the upper jaw, but not arising from caries. Facial neuralgia, especially of the right side, with feeling of numbness and stiffness, generally caused by cold. Facial neuralgia following herpes zoster; pains relieved by cold, aggravated by warmth. With the neuralgic pains of kalmia there are generally great weakness and trembling and symptoms of paralysis.

Magnesia phos.—Typical facial neuralgias; pains intermittent, darting, lightning-like, suddenly appearing and disappearing; pain especially in the supra-orbital branch; teeth sensitive; pains relieved by heat and pressure.

Mercurius.—Tearing pains, worse at night in bed; often start from a decayed tooth and involve the whole side of the face; worse in the evening and reach their highest degree of intensity about midnight; they are increased by the warmth of the bed and likewise by external cold. The pains are accompanied by great restlessness and sleeplessness, and very frequently the affected part is swollen and very sensitive.

Mercurius sol.—This is one of our best remedies where the dental branches of the fifth nerve are affected. The pains are stitching, tearing, boring, and are not limited to the point they start from, but radiate to the ear and forehead, and even occupy the whole side of the head. They are aggravated by the warmth of the bed, external cold, or draught of air, and gradually increase in severity from evening till midnight; are relieved by warm applications to the cheek.

Mezereum.—Ciliary neuralgia, pains radiate and shoot downward; there is a cold feeling in the eye, as though a stream of cold air were blowing on the eye; neuralgic pains come quickly and leave the part numb; facial muscles drawn tense; from the most painfully affected locality the pain spreads over the face and nape of the neck; pains break out in sharply defined paroxysms, are aggravated by warmth, especially by the warmth of a room after a walk in the open air; also diminished by hard pressure; pains are accompanied by chilliness or by muscular twitchings of the affected part, which is very sensitive to the least contact; pains may affect any or all three of the trifacial branches. This remedy is especially useful in syphilitic neuralgias when the bones are involved; also after the abuse of mercury.

Nux vom.—The pain is drawing, tearing, or jerking, mingled with violent, short, keenly acute stitches or with throbbing pulsations; tearing pains in the course of the infraorbital branch of the trigeminus, with redness and watering of the eyes, a flow of clear water from the nostrils, and numbness of the affected side; pains more violent early in the morning; the pain comes in paroxysms; the pain may shift to the other branches of the trigeminus. Neuralgic toothache from taking cold, involving even healthy teeth; feeling as if they would be wrenched out. Supra-orbital neuralgia, occurring early every morning; the patient is morose, irritable, belches a great deal, and is constipated; pains worse from noise, motion, cold air, and especially worse immediately after eating and after the use of coffee or liquors; better in a warm room, at rest, and when lying down.

Pulsatilla.—Neuralgia of the face, involving the whole side of the face; skin of the face painfully sensitive; pains twitching, tearing, or else jerking, lancinating—a maddening pain, sensation as if the nerve were violently put upon the stretch and then suddenly let go again; associated with the pains there is chilliness; pains are worse at night, especially in a warm room; are better in the *open air* and from the application of cold water. Neuralgic toothache, ceasing entirely in the open air, worse in a warm room, always relieved when walking about. Toothache of pregnancy, always worse in the evening until midnight; temporary relief from holding cold water in the mouth. In toothache calling for pulsatilla the pain is not located in any one single tooth, but seemingly affecting many.

Rhododendron.—Facial neuralgia, involving both dental nerves; pains drawing, tearing, and jerking, worse from change of weather, better from warmth and eating.

Sanguinaria.—Facial neuralgia spreading all over the head. Neuralgia in the upper jaw, running to the nose, eye, ear, neck, and side of the head; pains shooting and burning; patient bends over and holds the head tightly toward the floor to get relief; severe pain in the head, in rays, drawing upward from the neck.

Sepia.—Facial neuralgia, intermittent; with congestion of eyes and head, jerking, like electric shocks upward; pains appear in the morning immediately on awakening, or none in daytime, but severe at night, spreading over the lower and upper maxillæ, radiating to the vertex, occiput, neck, arms, and fingers; tearing drawing pains in the face and nose; swelling of the cheeks; pain frequently extends through ear, especially the left. Supra-orbital neuralgia, usually on the right side, associated with heaviness of the upper lids; the attack is brought on by fatigue or anxiety. Facial neuralgia during pregnancy, intermittent, severe only at night. Especially useful in the toothache of nervous women who are pregnant or who suffer from menstrual disturbances; pains aggravated by taking either hot or cold things into the mouth, from damp weather, and from excitement; better from pressure, being in a warm room, lying quiet, and from sleep.

Spigelia.—Spigelia is one of our most efficient remedies in facial neuralgia; the pain may be on either side, more frequently, however, on the left; pains tearing, burning, shooting. Ciliary neuralgia, the pains radiating in every direction and extremely severe; sharp stabbing pains in the eye, or radiating from the eyes to the temple, to the malar bone, and teeth; the supra-orbital region tender to touch; the eyeball feels swollen, as if too large for the orbit; associated with these symptoms is a flow of water from the nose and eyes. Ptosis, with sharp pains and hot lachrymation. Ciliary neuralgia, coming and going with the sun and worse at midday; pains also worse in damp weather, from touch, motion, and when lying down; better when sitting up; either cold or warm applications relieve. Neuralgic toothache of the most violent, shooting character; the pain is not seated in one tooth, but in an indefinite number of teeth, especially in the anterior row; the pain is a flashing, not a throbbing pain; the pain darts even into the face; is generally felt in daytime, less frequently at night; is aggravated by cold air, cold water, and eating; is relieved by the application of tepid warmth, and during rest.

Stannum.—Intermittent supra-orbital neuralgia from 10 a. m. to 3 or 4 p. m.; the pain comes on slowly, increases to its greatest intensity, then slowly declines; after a brief interval of rest, the pain again returns. Especially useful after the abuse of quinine.

Thuja.—Ciliary neuralgia; the pains radiate and shoot upward and backward; there is a cold feeling in the eye, as though a stream of cold air was blowing on the eye; acute shooting pains throughout the course of the infra-orbital nerve, producing flashes of heat in the face and a sensation of internal heat; cramping pains, with muscular twitchings; convulsive movements of the upper lip accompanying the exacerbations of pains; pains ameliorated by motion and by the open air.

Electrical Treatment.—The ordinary forms of neuralgia of the fifth nerve are often dispersed quickly by the use of electricity; but the more severe forms, such as tic douloureux, yield very slowly, if at all, to its use. In the greater majority of cases the galvanic current will give the best results. The positive electrode, a small one, is placed successively on the points of emergence of the several branches of the nerve, the current being localized mainly upon these points. The negative electrode, a large one, is applied to the nape of the neck; the sitting lasting from eight to ten minutes.

In those forms of neuralgia associated with general debility, static electricity will usually prove the most serviceable. It may be applied in the form of static insulation, or by means of the spray or the head breeze.

In those forms of facial neuralgia where the pain is located in a tooth (or in the teeth), the faradic current will sometimes relieve the pain instantly. The current is conducted to the tooth through the dental electrode, and the alternate pole placed at the nape of the neck. The galvanic current will frequently give relief, the positive pole to the tooth, the negative to some indifferent point.

Surgical Treatment.—The operative procedures that have been done for the relief of the more severe forms of neuralgia, especially tic douloureux, are *nerve-stretching, nerve division, excision* of a part of the nerve, and *removal* of the Gasserian ganglion. By employing one of these surgical procedures the pain may in some cases be relieved for a variable length of time, from a few weeks to a year or two, while in others there may be no relief at all. Trigeminal neuralgia being often due to deep-seated organic changes, the result of treatment—therapeutic, electric, surgical, or otherwise—is, in many instances, only palliative.

Facial (Seventh Nerve).

The facial nerve is the great nerve of expression. At its origin it is purely motor, but in its course it receives filaments from the fifth and cervical nerves. It has its apparent or superficial origin in the lateral portion of the medulla oblongata, in the groove between the olivary and restiform bodies, just below the border of the pons Varolii.

Its deep origin is from a gray nucleus in the floor of the fourth ventricle. In the floor of the fourth ventricle the fibers spread out and become fan-shaped, some terminating in the cells of the gray substance, while others decussate, passing to the gray nucleus of the opposite side.

The cortical origin of the seventh is in the lower part of the central convolutions, especially the pre-central. The fibers pass down in the crusta at the inner side of the pyramidal or motor tract. They decussate and reach the nucleus. The facial, the auditory, and the small nerve of Wristberg* traverse together the whole length of the auditory canal. Then the facial and the nerve of Wristberg enter the aqueduct of Fallopius, follow its course through the petrous portion of the temporal bone, escaping from the cranial cavity by the *stylo-mastoid* foramen, and unite to form the common trunk of the facial. Within the aqueduct of Fallopius the seventh nerve gives off five branches:

1. The *large petrosal,* which supplies Meckel's ganglion; this branch is the motor root of this ganglion.

2. The *tympanic,* which is distributed to the stapedius muscle.

3. The *small petrosal,* which supplies the otic ganglion; this branch is one of the motor roots of this ganglion.

4. The *chorda tympani,* which passes through the cavity of the tympanum and joins the third division of the fifth nerve. The chorda tympani is the nerve that supplies taste in the anterior two-thirds of the tongue. The chorda tympani is probably the continuation of the intermediary nerve of Wristberg, for the weight of evidence seems now to incline to the view that the gustatory fibers go on to the brain, with the trunk of the facial nerve, as the nerve of Wristberg.

5. A *small communicating* branch passing between the facial and the pneumogastric; this branch supplies motor filaments to the pneumogastric; also sensory filaments pass from

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* The intermediary nerve of Wristberg, a small nerve formed by filaments given off from both the auditory and facial just before the facial enters the aqueduct of Fallopius. This nerve is now supposed to be the chief origin of the chorda tympanum nerve, and is associated with the special sense of taste in the anterior two-thirds of the tongue.

the pneumogastric and constitute a part of the sensory connections of the facial.

After its exit from the stylo-mastoid foramen, the facial gives branches to the occipital part of the occipito-frontalis; to the external ear; to the stylo-hyoid and digastric; then, after pass-

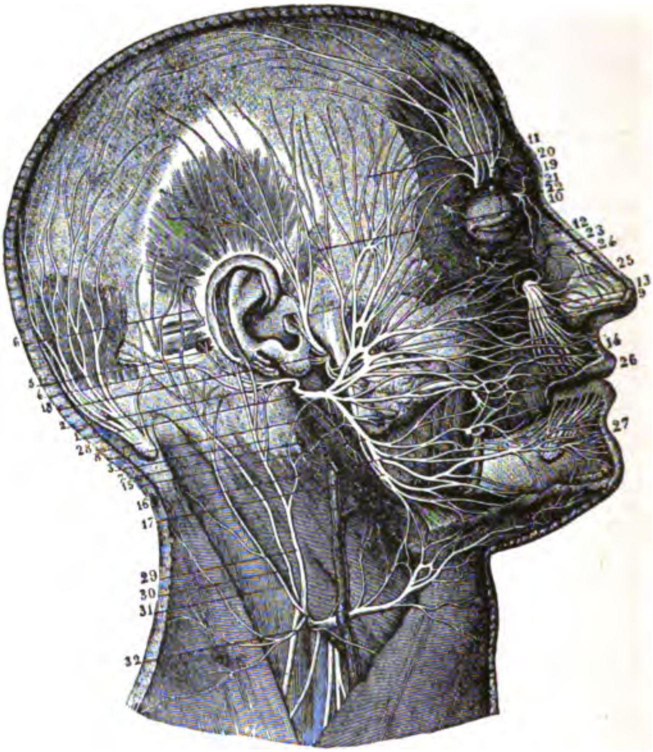

Fig. 36.—Superficial Branches of the Facial (Seventh) and the Fifth Nerves. (Hirschfeld.) 1, trunk of the facial; 2, posterior auricular nerve; 3, branch which it receives from the cervical plexus; 4, occipital branch; 5, 6, branches to the muscles of the ear; 7, digastric branches; 8, branches to the stylo-hyoid muscle; 9, superior terminal branch; 10, temporal branches; 11, frontal branches; 12, branches to the orbicularis palpebrarum; 13, nasal, or suborbital branches; 14, buccal branches; 15, inferior terminal branch; 16, mental branches; 17, cervical branches; 18, superficial temporal nerve (the fifth); 19, 20, frontal nerve (branches of the fifth); 21, 22, 23, 24, 25, 26, 27, branches of the fifth; 28, 29, 30, 31, 32, branches of the cervical nerves.

ing through the parotid gland, divides into two branches. The first, the larger, passes forward and upward, and is distributed to the muscles of the upper part of the face. The other branch passes downward and forward, and supplies the muscles of the lower part of the face and the orbicular oris.

The facial nerve supplies motion to all the muscles of the face, with the exception of the muscles of mastication, which are supplied by the third division of the fifth nerve.

Lesions of the Seventh Nerve.

As the facial nerve is motor in its functions, its diseases are spasmodic and paralytic.

Facial Spasm.—Facial spasm, also called *mimetic facial spasm,* or *convulsive tic,* is an affection characterized by involuntary twitches of the facial muscles, chiefly those supplied by the upper branch of the seventh, especially the muscles of the eyelid. The spasm may be clonic or tonic. It is usually unilateral. It may be confined to a single muscle or a group of muscles, or, in rare instances, affect all the muscles supplied by the facial nerve. The spasm is increased by emotions, nervous excitement, and exposure to light and cold. There is no pain associated with the spasms; no paralysis or wasting of the muscles affected; and no change in the electrical irritability. This affection may be due to organic or to functional disease, such as diseases at the base of the skull; lesions affecting the facial center in the cortex; reflex irritation, especially irritation of the branches of the fifth, as from over eye-strain, irritation of the branches supplying the teeth, etc.

One type of this form of spasm is that termed " nictitating " or " winking " spasms—a clonic spasm of the orbicularis. This form of spasm is met with quite frequently in hysteria and in habit-chorea.

Facial Palsies.

There are two types of facial paralysis. *cerebral* and *nuclear* or *peripheral.*

In the cerebral type the lesion affects the cortex of the brain or the nerve-path from the cortex to the nucleus in the floor of the fourth ventricle.

In the peripheral type the lesion may affect the nucleus or the nerve at any point between the nucleus and its peripheral distribution. The part of the nerve which is most frequently affected is that which passes along the Fallopian aqueduct. In this part a very little swelling of the nerve or of the walls of the aqueduct is sufficient to cause compression of the nerve-fibers. The character of the paralysis differs as to whether the upper segment (the cortex and the path leading to the nucleus of the nerve) or the lower segment (the nucleus and the nerve proper) is involved.

When the lesion affects the cortex or the fibers leading from the cortex (upper segment), the face is paralyzed chiefly in the lower part, the muscles of the upper part of the face, especially the orbicularis palpebrarum, rarely being implicated (the patient can close the affected eye as well as the normal one), and associated with this there is usually monoplegia or hemiplegia; there is no loss of faradic irritability.

When the lesion is situated in the anterior part of the pons, anterior to an imaginary line (Gubler's line) drawn through the points of escape of the trigemini, or involves parts of the encephalon anterior to the pons Varolii, the facial paralysis will be upon the same side as the hemiplegia. If the lesion be situated either in the lower part of the pons Varolii or below it, the face is paralyzed on the same side as the lesion or on the opposite side to the hemiplegia—known as crossed paralysis of the facial nerve and body type. Crossed paralysis affords valuable information respecting the seat and extent of the lesion.

Facial paralysis of *cerebral* origin may be due to hemorrhage, softening, inflammation, or tumors involving the cortex of the brain or the white substance immediately beneath it.

When the lesion affects the nucleus or the nerve proper, all branches of the nerve are affected, and consequently the muscles both of the upper and lower part of the face are completely paralyzed. This form of paralysis is termed ***peripheral paralysis*** of the seventh nerve, or, more commonly, "Bell's palsy," after Sir Charles Bell, who divided this nerve, with the erroneous idea of curing a facial neuralgia, and afterward gave a full description of its nature.

Bell's Palsy.

Ætiology.—Injury, either from a direct blow on the nerve or indirectly from a fracture of the base of the skull; forceps pressure in difficult labor; diseases of the ear; tumors or hemorrhages at the base of the brain; hemorrhage into the sheath of the nerve; tumors or abscesses of the parotid glands; syphilis; in rare instances congenital.

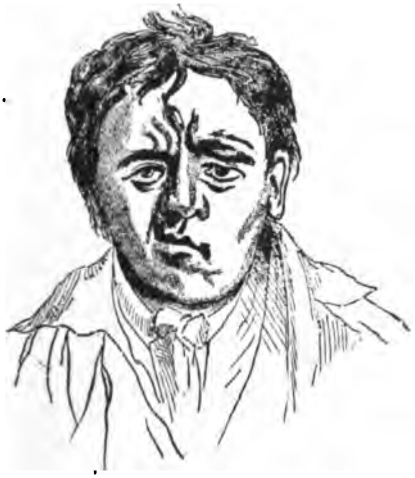

FIG. 37.—BELL'S PALSY. Showing the smoothing out of the wrinkles on the affected side of the face and forehead and the drawing of the corner of the mouth to the unaffected side.

But the chief cause of this form of paralysis is exposure to cold, thus setting up a neuritis—often termed "rheumatic." Double facial paralysis is rare. It may be caused, according to Gowers, by a lesion in the middle of the pons Varolii, a double otitis, multiple neuritis, and in paralysis from cold.

Symptoms.—The paralysis may come on suddenly or slowly, reaching its height within a few hours, or may require several days. In complete facial paralysis the face on the affected side becomes smooth and expressionless. The furrows and wrinkles become smoothed out and disappear.

In all movements, voluntary or emotional, the affected half of the face is still. The eye remains open (the eyelids cannot be brought together) on account of paralysis of the orbicularis palpebrarum. The lips cannot be pressed together on the palsied side, thus permitting a flow of saliva from the corner of the mouth; also in drinking the liquids run out of the palsied corner of the mouth, and the patient has to incline his head to prevent this. The angle of the mouth is drawn to the opposite side of that affected, on account of the unopposed action of the muscles upon the healthy side. The patient cannot whistle or blow out a candle. In laughing or other emotional movements of the face the deformity is much more apparent. Slight drooping of the angle of the mouth may be the *only* sign of paralysis during rest. On account of the paralysis of the cheek (the buccinator muscle), the patient has a puffing movement with each respiration, as though he were smoking a pipe; also mastication is interfered with, as the cheek can no longer force the food between the jaws, and consequently there is a tendency toward an accumulation of food within the cheek of the affected side. There is some difficulty in inspiration, on account of the inability to dilate the nostrils; also some difficulty in deglutition and in the pronunciation of certain words; also a difficulty in the expulsion of mucus collected in the back part of the mouth and pharynx.

When both sides are affected, the appearance is remarkable: the face being absolutely expressionless and looking as if it were covered with a mask.

A lesion affecting the facial nerve above the origin of the chorda tympani causes loss of taste in the anterior two-thirds of the tongue.

In facial paralysis of peripheral origin, the faradic reaction disappears within the first ten days, often within the first week; while in that of cerebral origin there is rarely ever any change in the faradic irritability. Another point in the differential diagnosis between the paralysis due to a cerebral lesion and one due to a lesion of the nucleus or the nerve-fibers, is that in the former there is very little, if any, reaction of degeneration, while in the latter there is reaction of degeneration.

In facial paralysis of the peripheral type the patient loses the power to close the eye and whistle; in facial paralysis due to a cerebral lesion the patient can close the eye and whistle.

Course and Duration.—Facial paralysis may run its course within ten days to two weeks; again, in others, it may require anywhere from three to nine months; in still other cases there may never be a complete recovery. If there is complete paralysis for a month, some trace of it always remains.

If the disease lasts for two months or more, and the palsy is not a complete one, secondary contractions begin to appear. The mouth now becomes drawn to the affected side, and the naso-labial fold becomes deeper than that on the sound side. In smiling or speaking or other facial movements there is an excess of movement on the paralyzed side, the teeth and upper gums in particular showing abnormally. (Dana.)

If the palsy is a complete one, contraction usually begins about the fourth or sixth month after the onset of the paralysis, and slowly increases from eight to twelve months, and then remains stationary or lessens.

Prognosis.—The prognosis is generally favorable. It depends upon the character and seat of the lesion. If due to neuritis caused by cold, or if due to syphilis, it is usually favorable. The prognosis is mainly founded, however, on the electrical reaction. According to Gowers, if at the end of ten days the irritability of the nerve is not below the normal, the face will probably be well in a few weeks. If, on the other hand, at the end of two weeks the irritability of the nerve is absolutely lost, the paralysis will certainly last for several months. If at the end of two weeks the nerve-irritability, although lowered, is not lost, recovery will probably occur in about two months. When the faradic irritability has been absent for some weeks, any return of excitability in the nerve-

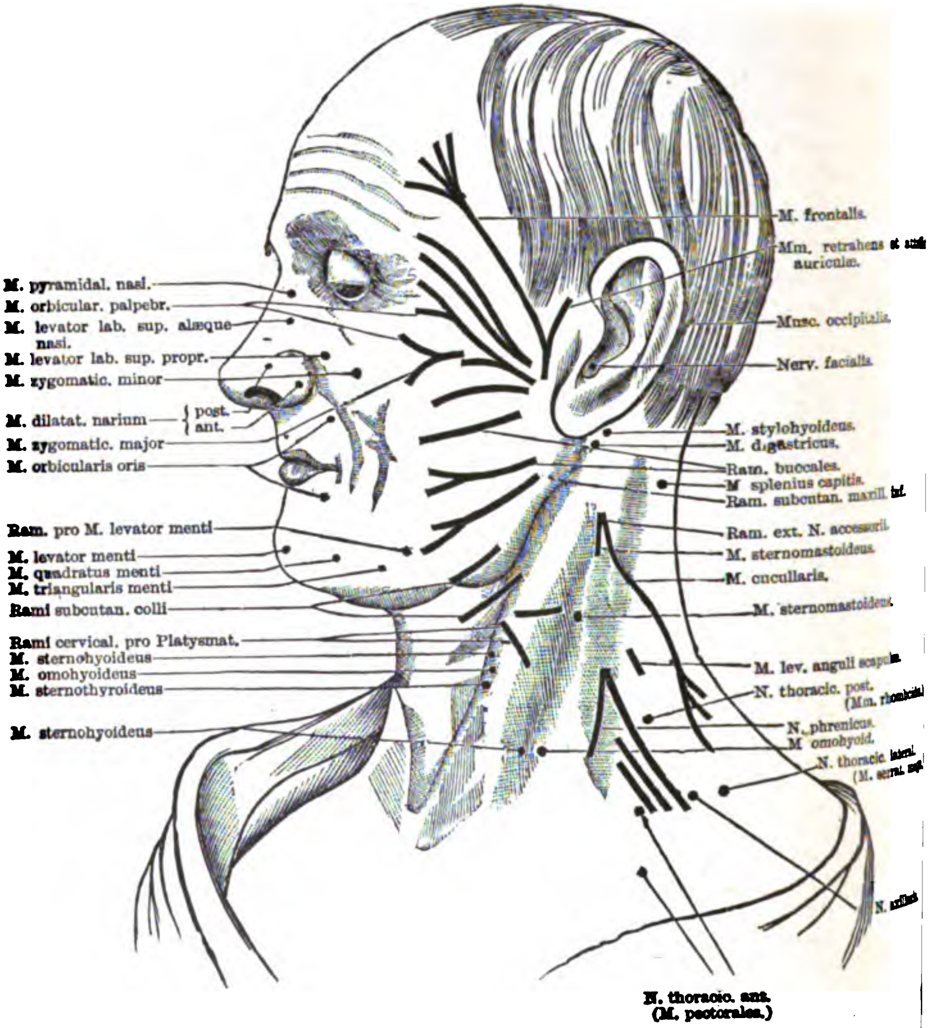

FIG. 38.—MOTOR POINTS OF FACE, SHOWING THE POSITION OF THE ELECTRODES IN ELECTRIZATION OF THE FACIAL NERVES AND MUSCLES. (After Rosenthal.) The indifferent electrode is placed in the mastoid fossa, and the active one upon the parts indicated in the figure.

fibers indicates a speedy return of some power in them. In the great majority of cases faradic irritability begins to return at the end of five or six weeks.

Electrical Treatment.—Leszynsky (" International System of Electro-th rapeutics ") gives the following method of application of electricity in facial paralysis: " The electrodes (two inches in diameter) and face being thoroughly moistened with warm water, the *anode* is placed either over the stylo-mastoid foramen or in the fossa below the ear. The *cathode* is held in position over the various branches of the nerve in turn (stabile method), and a current of about two to four milliamperes allowed to pass for one minute at each point. The strength of the current must be graduated according to the sensations of the patient. Each group of muscles is then made to contract by the interrupted galvanic current by the opening and closure of the circuit, without its removal from the surface of the skin. The entire *seance* should last about ten minutes daily, or every alternate day."

As soon as the muscles will contract to the faradic current, it should be employed. Massage will prove beneficial, and the patient should practice facial gymnastics daily. In those cases where the eye cannot be closed it should be protected by a shade. For therapeutical treatment, compare " Neuritis."

Auditory (Eighth Nerve.)

The auditory or eighth nerve is the special nerve of the sense of hearing, and is distributed exclusively to the *internal ear;* being the only nerve capable of receiving and conveying to the brain the special impressions produced by wave sound.

The origin of the auditory nerve can be traced to the floor of the fourth ventricle, where it divides into two roots—an external or superficial root and a deeper one. The external or superficial root consists of a number of filaments, a part of which, together with a part of those of the deeper root, decussate in the median line, forming the " linea transversal."

The deep root arises chiefly from a gray nucleus in the floor of the fourth ventricle. Some of the filaments that form the deeper root have been traced to the white substance of the cerebellum.

According to Spitzka, the posterior auditory root is the direct path for the transmission for the sound impulses, and the anterior auditory root is a path for the transmission of impressions which assist in the determination of equilibrium. Of the auditory path to the cerebrum we know only that it passes by the posterior part of the internal capsule.

The two roots, uniting, wind around the restiform body, pass forward across the posterior border of the crus cerebelli, and, in company with the facial nerve, enter the internal auditory canal and divide into two branches: (1) The cochlear, or anterior, which is distributed to the cochlea; this branch has to do with the sense of hearing; (2) the vestibular, or posterior, which is distributed to the vestibule and semicircular canals, and has to do with that sense by which we appreciate the position of our body and its relation to space. The eighth nerve is thus an auditory and space sense nerve.

Morbid Affections of the Auditory Nerve.

One of the most common symptoms indicating disease or loss of function of the auditory nerve is deafness. Deafness may be congenital or may be the result of disease. Congenital deafness is almost generally bilateral. It entails dumbness in after-life—a condition known as *deaf-mutism;* it is often due to defective development of the internal or middle ear.

Deafness due to disease may be the result of disease of the middle ear or due to a lesion or loss of function of the auditory nerve or its nuclei of origin—termed *primary nervous deafness.* The majority of the cases of deafness belong to the former class, and for a fuller account of causes and symptoms of this class any standard work on " Diseases of the Ear " should be consulted. It is the latter type, *primary nervous deafness*, which comes within the domain of the neurologist.

Nervous Deafness.

Primary nervous deafness may be due to a lesion of the temporo-sphenoidal lobe or the white substance within it; a lesion of the internal capsule; a lesion of the medulla, as hemorrhage or softening; tumors pressing upon the nuclei of origin of auditory nerve, or upon the nerve itself; basal meningitis; fracture of the temporal bone, causing injury to the nerve; falls or blows upon the head; syphilitic growth of the bones; syphilitic degenerative changes affecting the nerve.

A lesion in the left temporal lobe causes a form of sensory aphasia, called word deafness. (Dana.)

Nervous deafness may be due to functional as well as structural causes, as, for example, deafness occurring in hysteria.

Nervous deafness is often accompanied by general debility, and seems to arise from causes which have a tendency to weaken the tone of the nervous centers, such as grief, anxiety, sleeplessness, over-exertion of mind or body; also it may come on during convalescence of acute diseases, such as typhoid, pneumonia, etc.

In arriving at a diagnosis we must take the history of the case, whether there has been any discharge of a purulent character of the external ear, the duration of deafness, and whether there are any concomitant or nervous symptoms. The external meatus must be carefully examined by the aid of the ear speculum, to ascertain whether there is an accumulation of ear wax, a tumor or polypus, or whether the membrana tympani is or is not intact.

There is another means of helping to decide whether the deafness is primarily of nervous origin, or whether it is due to some chronic inflammatory disease of the middle ear. This is by testing the patient's ability to appreciate the vibration of a *tuning-fork* through the bones of the skull.

Bastian gives the following method to be employed: " After having been struck, its extremity is placed upon some part of the scalp, either in the middle line or toward one or other ear.

In case of *primary nervous deafness* the ability to hear the tuning fork through the bones of the skull on the affected side is *decidedly diminished*. On the other hand, in case of disease of the *middle ear*, although the vibrations of the tuning fork are heard much less distinctly on the affected side when the instrument is held alternately at a slight distance away from either meatus, they are, on the contrary, when the instrument is applied to the scalp in the middle line over the forehead or vertex, actually heard with more distinctness on the *affected* than on the non-affected side."

When the deafness is due to the obstruction of the meatus or disease of the middle ear (*i. e.*, whenever there is impaired conduction of vibration to the internal ear, and no disease of the labyrinth itself), there is deafness to vibrations that reach the ear through the air, while those that are conducted through the bones of the skull can still be perceived.

Sudden total deafness is characteristic of syphilitic disease of the internal ear.

The treatment of nervous deafness will depend upon the nature of the lesion.

Tinnitus Aurium.

This is an affection characterized by subjective noises in the ears, such as roaring, buzzing, whistling, clanging noises, escaping steam, ticking, etc. The sounds are generally present all the time, varying, however, in intensity, but giving the patient little rest and making life a burden.

It may be caused by irritative lesions of the auditory nerve; disorders of the central (cortical) auditory apparatus; reflex disturbances, especially from the region of the fifth cranial nerve; morbid constitutional states, including anæmia, general debility, renal disease; the effect of drugs, such as quinine* or salicylate of soda; it may be due to an accumulation of wax in the ear, but in the great majority of cases suffering from tinnitus the affection is due to disorder of the auditory apparatus, especially morbid conditions of the labyrinth of the internal ear.

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* Of the action of quinine upon the ears, and consequently a factor in the production of tinnitus aurium, Dr. J. O. Green says as follows: "From our present knowledge, both clinical and experimental, we are justified in asserting that the action of quinine upon the ears is to produce congestion of the labyrinth and tympanum, and sometimes distinct inflammation with permanent tissue changes."

Treatment.—Good results may be expected from the use of the galvanic current, especially when the tinnitus is associated with an irritable state of the auditory nerve. In such case the sedative effect of the positive pole will often act like magic. The positive pole should be applied either to the ear or to the mastoid process just behind the ear, and the negative pole to the nape of the neck.

The strength of the current should be increased gradually, stopping just short of " giddiness." Care should be taken that the current is turned on gradually and at the end of the treatment(about ten minutes) turned off gradually, so as not to give the patient an abrupt shock, for a sudden shock not only causes a return, but is liable to increase the noises in the ear. A good rule to follow is, *do not remove the electrodes until the current is reduced to zero.*

In many cases the noises may be diminished, or may entirely disappear during the treatment; at first the relief may be only temporary, the noises returning within a few hours, but after each sitting the period of quiet is longer, until they disappear altogether.

The treatment should be applied every day for a few days, and then every other day or twice a week, according to the progress of the case.

The special advantages of various forms of aural electrodes have been extolled, but, as a rule, they possess no special superiority in their results over the external application of electrodes. A remedy that has given me better results than any other in connection with the foregoing treatment is baryta mur. 3x; the next best is mercurius sol. 6x.

Auditory Hyperæsthesia.

Auditory hyperæsthesia is a condition where there is an increased keenness of hearing. Sounds which are inaudible to other persons are distinctly perceived. It may be of central origin (lesions of the medulla and the auditory center, also in cerebral diseases), or dependent upon some peripheral cause. It is met with occasionally in nervous or hysterical persons; also in individuals who are hypnotized.

Auditory Hallucinations.

This condition is met with in certain forms of insanity in which the patients imagine that they hear voices constantly repeating some words, or bidding them do certain acts, or they may imagine that they hear the voices of friends that are absent, or, even of dead persons. In other cases they hear musical sounds that, if it were not for the fact of their being continuous, would be pleasant. In others still these sounds may be hissing, or sound like the ticking of a clock.

These symptoms are always due to some disordered function in the cortex cerebri, and indicate a grave lesion.

Auditory Vertigo (Menière's Disease).

There is an affection associated with the auditory nerve known as auditory vertigo, or Menière's disease. In this affection paroxysms of vertigo are apt to occur from time to time, together with noises in the ears, vomiting, and temporary deafness.

The giddiness in auditory vertigo is much more severe than that met with in ordinary vertigo. In severe cases at the onset of the paroxysm the patient may fall to the ground, and it may be impossible for him to rise, so intense is the giddiness; such cases may have a momentary loss of consciousness. In other cases sight may be indistinct for a few minutes. Some cases have a rotary motion; others have a tendency to go forward or backward or sidewise.

After severe vertigo has lasted for a short time, nausea comes on, followed by vomiting. The patient is usually pale and haggard, sometimes perspires freely. The vertigo is often increased by any movement of the head, and any attempt to rise up brings on an attack of vomiting. This vomiting may continue for hours; and after the stomach is emptied, bile is brought up, as is usual in long-continued vomiting, and from this fact the patient concludes that he is "bilious," and that his attack was due to a disordered state of the digestive tract, or that his liver was out of order. Especially is this true where the ear trouble is of old standing, or when the patient is unconscious of any defect in his hearing.

This affection is supposed to depend upon some morbid condition of the semicircular canal—*i. e.*, there is an implication of the portion of the eighth nerve that supplies the semicircular canal. The precise nature of this affection is not known. It is accompanied with progressive deafness, and sometimes with tinnitus. When the deafness is complete, the vertigo ceases, because the nerve-end organ is destroyed.

In the treatment of this affection gelsemium, silicea, mercurius sol., and kali iod. have been the most serviceable.

The Glosso-pharyngeal (Ninth Nerve).

The apparent origin of the glosso-pharyngeal nerve is between the olivary and restiform bodies of the medulla oblongata, between the roots of the auditory nerve above and the pneumogastric below. The deep origin is in a gray nucleus in the floor of the fourth ventricle. From this origin the nerve passes forward and outward, and, together with the pneumogastric, the spinal accessory, and the internal jugular vein, makes its escape from the cranium through the jugular foramen.

The glosso-pharyngeal nerve is, in the main, a sensory nerve, though it contains a few motor fibers, derived chiefly from other nerves by filaments of communication, and also contains *taste* fibers.

The sensory fibers supply general sensation to the posterior part of the tongue, the soft palate, the upper part of the pharynx and larynx, the Eustachian tubes, and the tympanum. The motor part of this nerve supplies the middle constrictor of the pharynx, the levator palati, stylo-pharyngeus, and azygos uvulæ. These muscles are reached by fibers sent to the facial nerve, and afterward, by means of the great petrosal branch, to Meckel's ganglion.

The muscles supplied by this nerve are the ones concerned in the reflex act of deglutition. As Ranney remarks: " It will be thus perceived that the glosso-pharyngeal nerve possesses, within itself, all the necessary fibers to insure those successive acts of a reflex type which occur during deglutition, and it is by this nerve that the second act of deglutition is chiefly excited and performed."

The glosso-pharyngeal is the special nerve of taste for the *posterior third* of the tongue and for the soft palate. These fibers of taste, however, are believed to be derived from the fifth nerve. On this point Gowers says: " There is no instance on record of loss of taste at the back of the tongue from disease of the roots of the glosso-pharyngeal nerve, while there is evidence of its persistence in spite of such disease, and also that disease of the root of the fifth nerve causes loss of taste on the back as well as the front of the tongue, and on the palate and palatine arch; thus giving proof that the terminal ' taste ' fibers contained in the glosso-pharyngeal come ultimately from the fifth nerve. Their path must then be from the otic ganglion, through the tympanic plexus, to the petrous ganglion of the glosso-pharyngeal." As proof of this he cites the fact that taste on the back of the tongue may be lost in disease of the middle ear.

According to Bastian, a few fibers from the glosso-pharyngeal nerve pass through the intermediation of the *chorda tympani* and the *nerve of Wristberg* to the anterior two-thirds of the tongue, and minister to the sense of taste.

It is generally believed that nausea is produced through the agency of the glosso-pharyngeal nerve, especially nausea from pharyngeal irritation.

Lesions of the Glosso-pharyngeal Nerve.

This nerve is rarely, if ever, paralyzed alone, but is associated with paralysis of one or more other cranial nerves. A lesion of the ninth nerve may be caused by meningitis, tumors, focal lesions of the medulla, or hemorrhages, softening, etc.; but the most common lesion is a *chronic degeneration* of the roots of the nerve or of its nucleus in the bulb.

In this case not only is the ninth nerve involved, but also the auditory, the pneumogastric, the spinal accessory, and the hypoglossal, whose nuclei are in close relation with that of the ninth; thus producing the well-known form of paralysis termed *labio-glosso-laryngeal paralysis*, or Duchenne's disease.

The diagnosis of paralysis of the ninth nerve rests upon the implication of its sensory fibers—that is, upon the impairment or loss of the special sense of taste in the posterior third of the tongue and in the soft palate, and also upon the impairment or loss of common sensibility in the same parts and in the upper part of the pharynx; also when there is paralysis of this nerve, there is difficulty in swallowing, the food being regurgitated into the nostril.

Parageusia, or perversions and imperfections in the taste sense, are very frequent. They are generally due to irritation of the taste nerves from catarrhal inflammation of the stomach or mouth. (Dana.) They also occur in hysteria.

Ageusia, or the loss of the sense of taste, is an affection in which the power to discriminate the tastes of bitter, sweet, salt, acid, or alkaline substances is lost.

In the normal condition of the taste fibers of the tongue *bitter* substances are most tasted upon the *back* of the tongue, and *sweet* substances when placed upon the *tip*. By keeping this fact in mind it will often assist you in determining whether there is or is not any variation from the normal condition of the taste fibers of the tongue.

Pneumogastric or Par Vagus (Tenth Nerve).

The pneumogastrics, also termed par vagi (a pair of vags), on account of the wandering course which they pursue in order to reach their final distribution, present the greatest number of anastomoses, the most remarkable course, and the most varied uses of all the nerves emerging from the cranial cavity. Their area of distribution is far wider than that of any other cranial nerve, since they supply branches to the pharynx, the larynx, the lungs, the heart, the esophagus, the stomach, the intestines, the liver, the spleen, and possibly the kidneys and internal organs of generation.

The pneumogastric nerve at its root is mainly sensory, deriving its motor fibers chiefly from the spinal accessory. The apparent origin of the pneumogastric is from the side of the medulla, just behind the olivary body, between the roots of the glosso-pharyngeal and the spinal accessory.

The deep origin is mainly from what is called the nucleus of the pneumogastric, in the inferior portion of the gray substance in the floor of the fourth ventricle, near the calamus scriptorius. According to Meynert, some fibers of the pneumogastric pass to the cerebellum; this would help to account for the gastric derangements, such as nausea, vomiting, etc., met with in lesions of that organ. Some fibers have been traced forward to the tegmentum, and a few toward the cerebrum.

The central connections of the vagi in the cerebral hemispheres extend to or are connected with those parts which are concerned in emotion, and, as Gowers has suggested, it is apparently through the agency of these nerves that the heart's action is affected in excitement and in fever.

The nerve filaments from the superficial origin (eight or ten in number) unite, forming a flat cord, which, being inclosed in the same sheath with the internal division of the spinal accessory, passes outward and escapes through the jugular foramen.

There are two ganglionic enlargements belonging to the pneumogastric. The upper ganglion, lying within the jugular

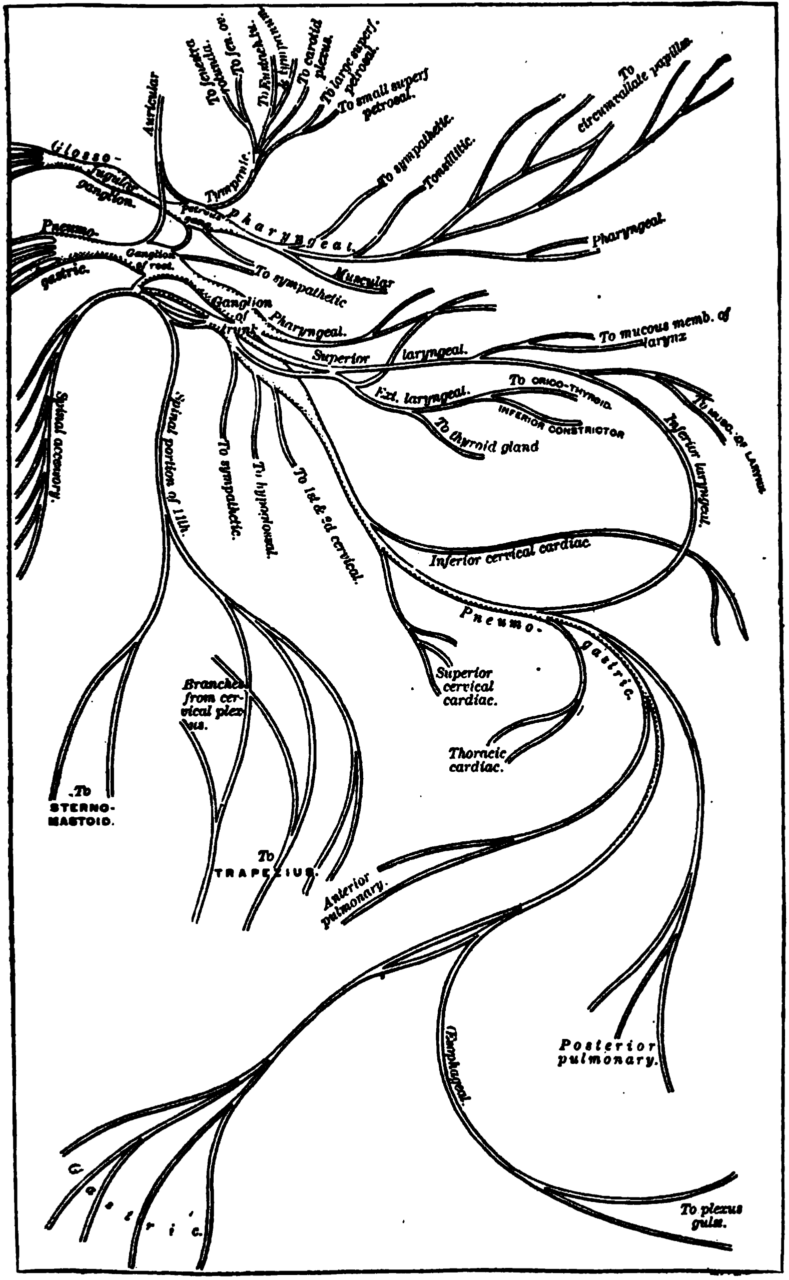

FIG. 39.—DIAGRAM SHOWING THE COURSE OF THE GLOSSO-PHARYNGEAL, PNEUMOGASTRIC, AND SPINAL ACCESSORY NERVES. (Gray, after Flower.)

foramen, is called the *jugular ganglion,* or ganglion of the root; it is of a grayish color, ovoid in form, from one-sixth to one-fourth of an inch in length, and resembles the ganglion on the root of the fifth nerve. Within the jugular ganglion an interchange of fibers takes place between the pneumogastric and spinal accessory nerves, the pneumogastric receiving motor filaments from the spinal accessory, and the spinal accessory receiving sensory filaments from the pneumogastric. The lower ganglion (a ganglion developed upon the nerve-trunk immediately after the nerve has emerged from the jugular foramen), termed the *ganglion of the trunk of the nerve,* is a grayish enlargement, half an inch to an inch in length. The great majority of the fibers of the internal portion of the spinal accessory pass over this ganglion and unite with the pneumogastric just below it.

The trunk of the nerve, after receiving the spinal accessory fibers, passes down the neck behind and in the same sheath with the carotid artery.

The nerve of the right side enters the thorax over the subclavian artery, and thence passes along the side of the trachea to the back of the root of the lung, where it spreads out into the posterior pulmonary plexus; from this point it passes down by the side of the esophagus, and thence to the posterior surface of the stomach and the solar plexus.

The nerve of the left side enters the thorax between the subclavian vein and the carotid artery, then passes behind the left innominate vein and over the arch of the aorta to the back of the root of the left lung, and along the front of the esophagus to the anterior surface of the stomach, and thence on to join the left hepatic plexus.

Functions of the Vagus.

The functions of the vagus are best studied in connection with its individual branches, but, speaking generally of the nerve as a whole, we may say that its functions are:

1. It is the inhibitory nerve of the heart—that is, it holds

that organ in check, keeps it from " running away with itself," and, as one writer puts it, if both vagi were divided, the result would be somewhat similar to those which might result if the governor of a steam-engine were suddenly removed, and the piece of mechanism allowed to proceed without its controlling influence.

2. It contains accelerating and inhibitory fibers, which control the respiratory center.
3. It is the chief motor nerve of the pharynx and larynx.
4. It is the sensory nerve of the esophagus and also the sensory nerve for the stomach and intestines.
5. It supplies motor fibers to the circular muscles throughout the greater portion of the alimentary tract, causing, when stimulated, the well-known peristaltic movement.

Lesions of the Vagus.

The causes of lesions of the vagi nerves are: Softening of the medulla, tumors pressing upon the roots of the vagi, neuromata, and atrophy of the vagi.

In studying the effect of lesions of the vagus it is better to study the effect of lesions of the different branches before considering the effects of lesions affecting the trunk of the nerve.

In studying the effects of lesions of the different branches an important point is to remember the order and different levels at which the several branches are given off from the parent trunk.

Branches of the Pneumogastric.

The most important are the following:

1. Auricular.
2. Pharyngeal.
3. Superior laryngeal.
4. Inferior or recurrent laryngeal.
5. Cardiac, cervical, and thoracic.
6. Pulmonary, anterior and posterior.
7. Esophageal.
8. Abdominal.

The *auricular branch* arises from the ganglion of the root, and is the common sensory nerve for the integument of the back of the pinna. Lesion of this nerve, if destructive, causes loss of common sensibility of the parts to which it is distributed.

The *pharyngeal branch* is composed, in the main, of motor fibers derived from the spinal accessory. The pharyngeal nerves are given off from the superior portion of the *ganglion of the trunk*, and, after receiving a branch from the accessory portion of the spinal accessory, combine with branches from the glosso-pharyngeal and the sympathetic to form the pharyngeal plexus. The ultimate filaments of distribution pass to the muscles and the mucous membrane of the pharynx and soft palate; it being the principal innervator of these parts.

Paralysis of the Pharyngeal Nerves.—If the lesion is of sufficient degree to cause paralysis and only one nerve is affected, the paralyzed side of the soft palate is seen to be lower and less arched than its fellow; the patient's power of swallowing may be interfered with, although not gravely impaired. This is due to the circular arrangement of the muscular fibers, the non-paralyzed nerve being sufficiently able to compensate for the lack of power in its fellow. In some cases the voice may have a slight nasal " twang," while in other cases it is not affected.

In bilateral paralysis of the pharyngeal branches, swallowing is extremely difficult; solid food entering the pharynx from the mouth has a tendency to lodge there, instead of descending to the esophagus; fluids are apt to run either into the larynx, producing symptoms of suffocation and violent paroxysms of coughing, or tend to regurgitate through the nose during the act of deglutition.

Bastian says that there are only two other conditions causing difficulty of deglutition that are at all likely to be confounded with paralysis of the muscles of the pharynx. The first of these is organic disease of the lower end of the pharynx, in the form of a carcinomatous or other kind of new growth. But where the history of the case leaves any room for doubt on this head, it may be easily set at rest by the passage of a bougie. The second condition is usually of neurotic origin, and is met with in highly nervous or hysterical individuals. Similar spasms occur during the paroxysms of hydrophobia.

Laryngeal Branches.—Of the two branches of the vagus supplied to the larynx, the *superior laryngeal,* which comes off the trunk of the nerve at about the level of the third cervical vertebra, is the sensory nerve of the larynx above the vocal cords, and supplies motor filaments to the crico-thyroid muscle, which is the tensor of the vocal cords, and to the deflectors of the epiglottis.

Paralysis of the motor fibers of the superior laryngeal, if unilateral, causes no appreciable symptoms; if bilateral, the voice would be harsh and deep, and it would be impossible to produce high notes, owing to the loss of tension of the vocal cords.

Paralysis of the sensory fibers of the superior laryngeal rarely occurs alone, but usually as part of the symptoms caused by a lesion of the trunk or of the roots of origin. When these branches are paralyzed, there is loss of sensation in the upper part of the larynx, and on account of this liquids or foreign bodies often pass into the larynx, owing to the absence of reflex closure of the glottis when foreign matter comes in contact with the superior surface of the larynx. Also the reflex acts in deglutition are impaired, on account of the loss of sensibility of the mucous membrane of the epiglottis, of the aryteno-epiglottidean fold, and of the larynx as far down as the true vocal cords. Irritative lesions of the sensory fibers of the superior laryngeal may cause attacks of spasmodic coughing or may cause a sensation as though a foreign body was lodged in the larynx.

The *inferior* or *recurrent laryngeal,* so called from its reflected course, separates from the vagus in the upper part of the thorax, and passes up to the larynx between the trachea and esophagus. In the main, it is a motor nerve, supplying motor power to all the muscles of the larynx, except the two supplied by the superior laryngeal, and, according to Gowers, supplies sensibility to the larynx below the vocal cords and to the whole trachea.

All the motor fibers for the larynx come from the spinal accessory. This branch of the spinal accessory is the *true* nerve of *phonation* governing the production of vocal sounds. Only the sensory fibers pass to the medulla by the roots of the pneumogastric.

In unilateral paralysis of the inferior laryngeal the vocal cords (as determined by laryngoscopic examination) on the affected side cannot be brought to the middle line as the other cord is during phonation, nor can it be moved outward like its fellow during inspiration. The voice may be hoarse or it may be little altered, as in some cases the healthy cord can be brought even a little beyond the middle line, and consequently so near to the palsied cord as to give rise to only a very slight defect in phonation. (Bastian.)

Coughing is more or less impossible, on account of the inability to completely approximate the vocal cords, which condition is necessary to produce a cough. Inability to cough and no loss of voice arc indicative of unilateral paralysis of the inferior laryngeal nerve.

In bilateral paralysis of the recurrent laryngeal nerves the voice is changed or lost on account of the inability to approximate the vocal cords.

In the later stages of this affection, when the vocal cords are in the position of *semi-abduction*, phonation is more or less impossible, and the power of coughing is similarly lost, but there is no interference with the respiration causing dyspnœa. In the later stages of this affection, when the paralyzed cords are in the position of *adduction*, phonation is comparatively easy, though the voice is high-pitched and stridulous.

The power of coughing is imperfect; although the cords are close to one another, they cannot be further approximated so as to completely close the glottis. (Bastian.)

Any extra or over exertion is liable to bring on a grave respiratory condition, such as dyspnœa with stridulous inspiration.

For the exact diagnosis of these laryngeal palsies, an examination by means of the laryngoscope is essential; but by comparing the symptoms of the different forms of paralysis we may be able, in the majority of cases, to arrive at a correct diagnosis of the case. In the following table, which is a slight modification of Gowers', the forms of paralysis are enumerated in the first column, the symptoms in the second, and the condition seen with the laryngoscope in the third:

LESIONS.	SYMPTOMS.	SIGNS.
Total bilateral palsy.	No voice; no cough; stridor only on deep inspiration.	Both cords moderately abducted and motionless.
Total unilateral palsy.	Voice low-pitched and hoarse; no cough; stridor absent or slight on deep breathing.	One cord moderately abducted and motionless; the other moving freely, and even beyond the middle line in phonation.
Total abductor palsy.*	Voice little changed; cough normal; inspiration difficult and long, with loud stridor.	Both cords near together, and during inspiration not separated, but even drawn together.
Unilateral abductor palsy.	Symptoms inconclusive; little affection of voice or cough.	One cord near the middle line, not moving during inspiration; the other normal.
Adductor palsy.	No voice; perfect cough; no stridor or dyspnœa.	Cords normal in position and moving normally in respiration, but brought together on an attempt at phonation.

The following deductions may be made from Gowers' table: The inability to effect an explosive cough is of great significance as evidence of a palsy of organic origin—in the absence, of course, of local organic disease.

Entire loss of voice, as well as of cough, suggests bilateral palsy of grave organic nature, but without loss of cough it indicates unimportant adduction palsy.

Loss of cough without loss of voice suggests paralysis of one cord. Loud inspiratory stridor without loss of voice means adduction paralysis.

Spasms of the Larynx.—Any irritation (direct, central, or reflex) of the laryngeal nerves results in spasmodic closure of the glottis, owing to the fact that the adductors are far more powerful than the abductors of the vocal cords. There is one form of spasm of the glottis commonly known as *laryngismus stridulus*, or *spasmodic croup*. This form of spasm tends toward asphyxia. It occurs most frequently in infants and in children under three years of age, though it occurs more rarely in older children, or even in adults. The attack usually commences quite abruptly, occurs more frequently during the night, and is most common during the cold months. The child is roused, perhaps from its sleep, or checked during the act of sucking, by a sudden catch in its breathing, more or less complete.

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* The terms *adductor* and *abductor palsy* mean paralysis of the muscles which close or separate the glottis.

Dr. Ley gives the following graphic description of the various stages in this affection: "When the closure of the chink of the glottis is not perfect, the child struggles for its breath; the respiration is hurried; the countenance generally bluish or livid; the eyes staring; and each *inspiration* is attended with a crowing noise. When the closure is more complete, the function of respiration is entirely suspended for a while, there is an effectual obstacle to the admission of air. The child makes vehement struggles, by some termed convulsions, to recover its breath. At varied intervals from a few seconds up to a minute, or upon some occasions nearly two minutes, air is at length admitted through the glottis now partially open; and this rush of air, passing through a very narrow chink, produces the peculiar sound. To these symptoms not infrequently succeeds a fit of coughing or crying, which terminates the scene; or, if the glottis be not thus partially open, the child, at the end of some two or three minutes at the utmost, will die suffocated. Pallid and exhausted, it falls lifeless upon the nurse's arm; and it is then that the child is generally said to have died in a spasm."

The peculiar ringing cough met with in pertussis, or whooping-cough, is due to the spasmodic closure, with subsequent imperfect relaxation, of the glottis.

Paralysis of the remaining branches (*cardiac, pulmonary, esophageal*, and *abdominal*) rarely, if ever, occurs alone, but almost solely as the result of disease or injury to the trunk or nucleus of origin of one or other of the pneumogastric nerves.

Cardiac Branches.—The cardiac nerves are the inhibitory nerves of the heart,* the nerves that govern the regulation, rapidity, and force of the cardiac pulsations. These nerves convey to the heart a constant influence, which may be compared to the insensible tonicity imparted to the voluntary muscles by the general motor system. When this force or tonicity is exaggerated, the action of the heart may be arrested temporarily or permanently; consequently any irritation of the trunk of the pneumogastric which affects its cardio-inhibitory fibers, or of its center (which is in the medulla oblongata), may diminish or altogether arrest the heart's action.†

When one nerve is paralyzed, the heart increases slightly in the rapidity of its pulsation and the amount of cardiac pressure becomes slightly diminished. When both nerves are paralyzed, the respiratory symptoms far outweigh those of the heart; but its action is still accelerated and often irregular, since the inhibitory power of the nerve is destroyed.

The heart may be affected as the result of a reflex act through the sympathetic nerve upon the cardiac center, and thus affecting the heart through the vagus; for instance, palpitation and irregular action of the heart may be caused by a full meal or from accumulation of gas in the stomach. Fright, anger, or grief may cause an arrest of the heart's action. This may be temporary, as in syncope or fainting, or permanent, resulting in death. Flint says that when death takes place, it is due to the fact that the nervous shock carried along the pneumogastrics is so great that the heart cannot recover from the effect of it.

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* Professor Weber has shown that inhibitory nerve-fibers do not go directly to the muscles, the action of which they inhibit, but that they enter into controlling centers or inhibitory ganglia distributed in the cerebro-spinal centers and the peripheral nerves. This is the reason why inhibition is generally exercised, not upon individual muscles, but upon sets of muscles.

† According to Tripier, there is a decided difference between the right and left nerve, inasmuch as the *right* acts more energetically on the *heart* than the left, while the *left* modifies the *respiratory movements* more profoundly than the right.

Faradization of the pneumogastric arrests the action of the heart, while faradization of the inferior cervical ganglion and its cardiac branches accelerates it.

Pulmonary Branches.—The pulmonary branches of the pneumogastric supply motor and sensory filaments to the lower part of the trachea, the bronchial tubes, and to the lungs proper.

The pneumogastric is the chief afferent nerve in connection with the respiratory center, conveying accelerating and also inhibitory impressions.

The acceleratory impressions, as a rule, greatly preponderate. (Bastian.)

Paralysis of one vagus causes the respiration to become slower, and the inspiratory movements to become less frequent, but more profound. Some observers have found the corresponding lung partly emphysematous and partly engorged with blood; others have not noticed any change in the pulmonary structure.

Paralysis of both vagi is followed by a gradual failure of respiration and death within a few days. Ranney says that if it were not for the nerves of the skin and other sensory nerves which can transmit the feeling of pain, and which also possess the power of exciting respiratory efforts, section (paralysis) of both vagi ought to (theoretically) stop respiration at once.

Spasms of the muscles supplied by the pulmonary branches produce a condition known as bronchial spasm or asthma. Asthma, then, is due to a spasmodic contraction of the smaller bronchial tubes, whose fibers are supplied with motor power by the pneumogastrics. This spasm may be developed by mental influences acting upon the origin of the vagi, may be produced by thoracic tumors pressing upon the vagi, or may be the result of reflex irritations.

There is one form of asthma, termed " nervous asthma," that is a neurosis dependent upon a morbid molecular condition or state of the nerve-centers, the tendency to establishment of such conditions being often inherited. (Bastian.)

Often this nervous asthma alternates with attacks of insanity. When the asthma is better, the mental symptoms are worse, or *vice versa*.

Esophageal Branches.—Paralysis of the branches of the vagus to the esophagus rarely occurs except in case of disease of the *nerve-trunk* or of *their* center. In such cases there is difficulty in swallowing; solid food would have a tendency to lodge in the upper part of the esophagus, thus simulating a stricture; but in case of doubt the passage of a bougie would determine this point.

Abdominal Branches.—As the branches which supply the stomach and bowels are in the main sensory, any lesion of the branches would be manifested principally as a sensory symptom.

The feeling of hunger is usually supposed to be a sensation dependent upon impressions reaching the brain through the sensory fibers of the vagus.

In case of disease of the vagus excessive appetite has been observed, the appetite being insatiable. It is supposed to exist when the nerve-fibers of the vagus distributed to the stomach are in a state of anæsthesia. (Ranney.) This condition may accompany softening of the medulla, tumors compressing the root of the vagi, and morbid states of the system, such as epilepsy, hysteria, and insanity.

Johnson noted a case in which there was complete loss of thirst and hunger in a lesion affecting the vagus. As the pneumogastric also contains motor fibers, paralysis would cause a diminution, though not an entire loss, of peristaltic action, thus causing the stomach to become enlarged.

Vomiting is probably produced through the agency of the vagus, by varied reflex and central irritations. (Gowers.) The vagi nerves have some controlling influence over the glycogenic function of the liver and the secretions of the intestinal juices. The inhibitory nerves of the intestines are the *splanchnic* nerves.

Faradization of these nerves, which take their rise from the six lower dorsal ganglia of the sympathetic, causes the peristaltic movements of the small intestines to be arrested. Sudden death may result from a blow or a kick on the abdomen. The stimulus conveyed by the blow reaches, at first, the sensitive nerves of the abdomen; these carry the impression to the spinal cord, from whence it travels upward to the medulla oblongata. The origin of the vagus is now reached, and from there the heart's action is arrested.

Spinal Accessory (Eleventh Nerve).

The eleventh nerve has a very extensive origin, since it derives its fibers not only from the medulla oblongata, but also from the cervical portion of the spinal cord.

It consists of two parts: (*a*) The accessory part, which arises from a nucleus of gray matter in the medulla, just below the origin of the pneumogastric. These fibers pass forward, making their exit through the jugular foramen, join the pneumogastric, and, as has been described, supply the muscles of the larynx and pharynx; thus controlling the muscles of phonation. The effect of a lesion or of disease of these fibers has been given when describing the pneumogastric, as these fibers go to make up the accessory portion of that nerve. (*b*) The spinal part, as it is termed on account of its origin, arises from the anterior horns of the gray matter in the spinal cord, as low down as the sixth or seventh cervical nerves. This part is, in fact, made up of the fibers of the motor cervical nerves. These fibers pass upward through the foramen magnum into the cranial cavity, joining the accessory portion, then pass outward to the jugular foramen, through which they pass lying in the same sheath as the pneumogastric, but separated from it by a membrane. This portion of the spinal accessory (the spinal part) is distributed to the *sterno-mastoid* and *trapezius* muscles.

Diseases of the Spinal Part of the Spinal Accessory.

This nerve being purely motor in its function, lesions would cause either spasms or paralysis, according as to whether they were irritative or destructive in character. The spasms may be unilateral or bilateral, and may be either of the tonic or clonic variety. Spasms of either variety may be caused by disease of the upper cervical vertebræ; by forced movements of the head; by exposure to cold and wet, thus setting up a form of rheumatic neuritis; and from local disorder of the brain and spinal cord. They may also be of reflex origin, due to irritation of the dental, the intestinal, or the uterine nerves. Bastian says that these spasms may occur after some marked emotional disturbance, during the puerperal period, or in the period of convalescence from typhoid or some other severe specific fever. They may be of congenital origin, due to some intra-uterine atrophy or obstetrical injury of the sterno-cleido-mastoid. Spasm of the muscles supplied by the spinal branch of the spinal accessory nerve, especially of the sterno-mastoid muscles, is met with quite frequently in connection with certain types of chorea and hysteria; also in persons of an hereditary neuropathic constitution.

Tonic Spasm.—Tonic spasm produces the condition known as " torticollis," or " wry-neck."

The spasm is most frequently limited to the sterno-mastoid on one side. In tonic spasm of one mastoid the chin is turned to the opposite side and raised; the head is drawn so that the ear of the affected side approaches the clavicle, the occiput, the tip of the shoulders. The patient cannot overcome this deformity of his own voluntary effort, and passive motion is strongly resisted. There may be some pain in the beginning of the affection, but this soon subsides. When the disease becomes chronic, the affected muscles hypertrophy while the antagonistic muscles (the muscles thrown into disuse) atrophy. In young children, especially, this condition may eventually result in curvature of the spine, with the convexity toward the sound side.

In tonic spasms of both sterno-mastoids the head is drawn forward and depressed upon the chest. If both trapezii are affected, the head is drawn backward. This condition is termed " retrocollic spasm."

Clonic Spasm.—In the clonic type of spasm the deflection of the head will be the same as in the tonic spasm, except that the duration of the contraction will be for a shorter period and of a convulsive variety.

In some instances the spasm is almost continuous in the waking hours, but, as a rule, sleep brings rest. The spasms are usually aggravated by mental excitement or by the patient's consciousness that he is being watched. In some of the more severe types of spasm the muscles of the face, jaw, and arm are thrown into simultaneous action.

In *bilateral* clonic spasm of the sterno-mastoid the head, instead of being persistently drawn forward and downward, as in the tonic spasm, is now affected with forward and backward nodding movements. This condition is met with more frequently in children than in adults.

Paralysis of the spinal portion of the accessory nerve may result from basilar meningitis; disease or injury of the occipital bones; disease of the upper cervical vertebræ; injuries to the nerve, such as cuts, stabs, and gunshot wounds of the neck; also from rheumatic and syphilitic neuritis.

In unilateral paralysis of the spinal portion of the nerve there is paralysis and wasting of the sterno-mastoid and trapezius. In the early stage of the paralysis there is very little deformity when the head is at rest. The head is turned toward the affected side, on account of the unopposed actions of the muscles of the healthy side. The chin is slightly elevated. The head cannot be easily rotated in the opposite direction by any effort of the will, though passive movement in this direction is easily brought about.

Paralysis of the upper third of the trapezius causes a depression in the contour of the neck, especially noticeable on deep inspiration. There is some trouble in raising the arm, because the deltoid has lost some of the support from the spine and the lower angle is rotated inward.

In bilateral paralysis of the spinal portion of the nerve there is paralysis of both sterno-mastoids and both trapezii, followed by atrophy and degenerative reactions. There is great difficulty in rotating the head or raising the chin. Paralysis of both sterno-mastoids causes the chin to drop backward, while paralysis of both trapezii in their upper parts causes the head to drop forward. In rare instances paralysis of the sterno-mastoid and upper part of the trapezius presents no marked symptoms, for these parts may be supplied by the cervical nerves.

The Hypoglossal (Twelfth Nerve).

The hypoglossal nerve is essentially a motor nerve, which supplies the tongue and most of the muscles attached to the hyoid bone.

It is the motor nerve of all the muscles which tend to depress the larynx and the hyoid bone, after they have been raised during the second stage of the act of deglutition, and to most of the muscles which act upon the tongue.

The superficial or apparent origin of the hypoglossal is from the groove between the olivary body of the medulla oblongata and the anterior pyramid, below the tenth nerve, on the line of the anterior roots of the spinal nerves.

Its deep origin is a nucleus of gray matter in the floor of the fourth ventricle, between the deep origin of the ninth and tenth nerves. These filaments of origin (ten to twelve in number) unite and form two bundles, which pass through the *anterior condyloid* foramen and unite into a single trunk as they emerge from the cranial cavity.

After the nerve escapes from the cranium, its branches of communication are with (1) the sympathetic; (2) the pneumogastric; (3) the first and second cranial nerves (according to Horsley, it is from these nerves that the motor fibers are derived which supply the depressors of the hyoid bone, and not from the hypoglossal nucleus); (4) a communicating branch to the gustatory branch of the fifth nerve.

Its branches of distribution are: (1) The descendens noni (the descending of the ninth nerve, so called since this nerve was classed by Willis as the ninth), which descends obliquely across the sheath of the carotid vessels, and joins the communicating branches from the second and third cervical nerves (communicans noni nerve) just below the middle of the neck to form a loop, from which filaments are given off which supply the sterno-hyoid, sterno-thyoid, and both bellies of the omohyoid; (2) the thyro-hyoid, which supplies the muscles of that nerve. Then there are several small branches which go to supply the stylo-glossus, the hyo-glossus, genio-hyoid, genio-hyoglossus, and the intrinsic muscles of the tongue. There are also several small filaments given off to the dura mater in the posterior fossa of the base of the skull.

Lesions of the Hypoglossal Nerve.

Lesion of the hypoglossal nerve is usually manifested by paralysis of the tongue, sensation and taste not being affected. Paralysis of the tongue (glossoplegia) may be either unilateral or bilateral, and may be either partial or complete. Paralysis of this nerve may be due to: (1) Lesion affecting its intra-cerebral fibers—that is, the motor tracts anywhere between the medulla and the lowest part of the ascending frontal convolution or the root of the third frontal. (Gowers.) In a lesion in this locality the tongue is paralyzed on the opposite side and associated with it is hemiplegia. (2) Lesion involving its nucleus of origin or root-fibers. A lesion in this region is usually of chronic degeneration (progressive bulbar paralysis), and is usually bilateral, on account of the two nuclei being so near together. (3) Lesion of the trunk (infra nuclear) of the nerve may be at any point between the surface of the medulla and the tongue. In such a case the paralysis is always unilateral and complete.

Unilateral Paralysis.—In unilateral paralysis the lesion is usually located in the intra-cerebral fibers (between the medulla and the cerebrum), in which case the tongue is paralyzed on the *opposite side* from the lesion; or in the nerve-trunk, in which case the tongue is paralyzed on the *same side* as the lesion. In unilateral paralysis the tongue, when at rest in its normal position in the mouth, presents no marked sign of disease, with the exception that the root is higher on the paralyzed side, in consequence of loss of the tonic contraction of the posterior fibers of the hypoglossus; but when the tongue is protruded, it turns toward the paralyzed side, owing to the genio-glossus being paralyzed or weakened on this side, thus permitting its fellow of the opposite side to push it toward the affected side; there is generally no marked interference with speech, chewing, or deglutition. Atrophy is not a marked symptom when the lesion is situated above the nucleus, but if the nucleus or nerve-trunk is diseased, the muscles of that side of the tongue waste away and shrink up.

Bilateral Paralysis.—Bilateral paralysis is usually due to a lesion involving the nuclei of the hypoglossal nerve, situated in the medulla; but may also be caused by lesion of both hypoglossal nerve-trunks. In complete bilateral paralysis the tongue lies motionless within the mouth and cannot be protruded. After a time there is more or less marked wasting of the muscles of the tongue; the tongue becomes shrunken; the mucous membrane (not being affected to any marked degree by this lesion) is thrown into irregular folds; mastication, deglutition, and articulation are difficult and imperfect. Atrophy may at times exist and yet be obscured by coincident or fatty overgrowth. In these cases the tongue lies motionless behind the teeth and has a broad, flabby appearance.

Spasm of the tongue is a symptom met with quite frequently in some forms of hysteria, chorea, epilepsy, etc. Spasm of the tongue is rarely met with as an independent affection, but is usually associated with some functional or morbid state of the nervous system.

Stuttering is a spasmodic disorder in which the tongue muscles are involved, preventing the proper enunciation of words and sentences.

Stammering is an imperfect articulation, due sometimes to disease or defect in the hypoglossal nerve and its muscles.

THE SPINAL CORD AND ITS MEMBRANES.

The Membranes of the Spinal Cord.

The spinal cord is enveloped by three membranes: The dura mater (for protection), the arachnoid (for lubrication), and the pia mater (for nutrition).

The spinal dura mater differs from that of the dura mater of the brain in that it is not closely adherent to the walls of the canal, but is separated from it by a considerable space, which is filled with venous plexuses, and large quantities of areolar tissue containing fat. This membrane serves as a sheath for the pro-

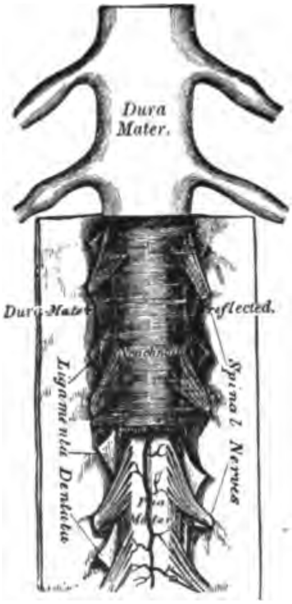

FIG. 40.—SHOWING THE SPINAL CORD AND ITS MEMBRANE. In the lower third of the figure the dura mater and arachnoid have been removed, showing cord covered with the pia mater; in the middle third of the figure the arachnoid and pia mater have been left intact, the dura mater having been reflected; the upper third of the figure shows the cord with all of its membranes intact. (After Gray.)

tection of the other membranes, the roots of the spinal nerves, and the cord and its vessels.

The spinal dura mater may be the seat of an inflammation secondary to disease or injury of the spinal column, or may be the seat of a hemorrhagic pachymeningitis. Tubercular inflammation of the dura mater spinalis may occur in connection with tubercular meningitis, or secondary to tubercular inflammation of the vertebræ. This membrane may be primarily the seat of tumors, fibromata, lipomata, endotheliomata, etc., or secondarily, as in carcinomata and sarcomata. These tumors may give rise to serious results from compression.

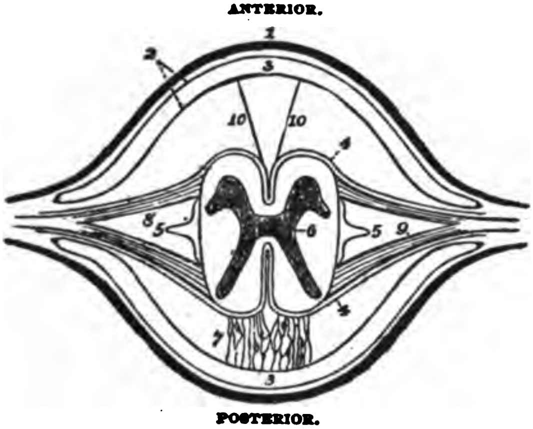

FIG. 41.—TRANSVERSE SECTION OF THE SPINAL CORD AND ITS MEMBRANES. Showing the different membranes and spaces as they exist in the spinal column. 1, 1, dura mater passing down to end on the sheath of the nerves; 2, 2, layers of arachnoid forming; 3, cavity of arachnoid; 4, 4, pia mater ending on nerve-sheath; 5, 5, ligamentum denticulatum; 6, gray matter of spinal cord; 7, delicate areolar tissue found in the subarachnoid space between the arachnoid and pia mater; 8, anterior and smaller, 9, posterior and larger, roots of spinal nerve; 10, 10, similar tissue to 7.

The spinal arachnoid is a thin membrane quite distinct from the spinal pia mater and separated from it by a considerable distance. This space is known as the "subarachnoidean space," and is filled with the cerebro-spinal fluid. The subarachnoid cavity communicates with the cavity of the brain, its fluid having free entrance to and egress from the ventricles of the brain by means of the aqueduct of Sylvius to reach the third ventricle, and through the foramina of Monroe to enter the two lateral ventricles.

The spinal pia mater is a much denser and firmer membrane than the pia mater of the brain; it is also less vascular and adheres more closely to the subadjacent nervous matter by means of prolongation into its substance.

The spinal pia mater may be the seat of an acute meningitis, occurring simultaneously with an acute cerebral meningitis. In other instances it may be entirely independent of those of the brain. The inflammation may be circumscribed, but usually affects the entire length of the membrane. It may also be the seat of a tubercular inflammation; but in that case it is usually associated with a similar condition of the pia mater of the brain. Hemorrhages may occur as the result of an injury, or follow general diseases, such as hemorrhagic diathesis, scurvy, smallpox, etc.

As in the case of the dura mater, it may be the seat of tumors, such as fibromata, myxomata, sarcomata, etc.

Spinal Meningitis.

(*Inflammation of the Membrane of the Spinal Cord.*)

The membranes of the spinal cord are subject to inflammation, which may be either acute or chronic. It may be confined to one membrane, or, beginning in one membrane, spread to another, and even extend to the cord (meningo-myelitis). When the dura mater is affected, it is termed " pachymeningitis " *externa* or *interna*, according as to whether it affects the outer or inner surface of the membrane.

When the inflammation affects the pia mater and arachnoid, it is termed " leptomeningitis," or *internal meningitis*.

External Pachymeningitis.

External pachymeningitis is almost always a secondary disease, due to an extension of inflammation from contiguous parts, as caries of the vertebræ (Pott's disease), tuberculosis, deep sacral bed-sores. (Gowers.)

The inflammation involves not only the membrane, but also the loose connective tissue between the dura and the vertebral canal.

The symptoms are usually secondary to and resemble those of the disease which produces the inflammation, as caries, etc. As a rule, however, they correspond so closely to those due to inflammation of the internal variety that it is more convenient to describe them under the one heading—"Leptomeningitis."

The prognosis is generally bad, because the original disease is a serious one.

The treatment would be that of the primary cause—the lesion causing the inflammation; also compare "Acute Spinal Meningitis."

Internal Pachymeningitis.

Internal pachymeningitis occurs most frequently in males and in the adult period of life. It may be the result of syphilis, alcoholism, exposure to cold; also from injuries to the spinal column. In the earlier stages the symptoms in the main resemble those of "leptomeningitis" (which compare), but in the later stages (six to eight months) there is a greater degree of paralysis, and associated with this there are contractures, rigidity, exaggerated reflexes, and muscular atrophy.

The prognosis is grave; the patient generally becomes weaker and weaker, and finally dies from exhaustion or from some intercurrent disease.

For treatment, see "Acute Spinal Meningitis."

Leptomeningitis (Acute Spinal Meningitis).

In this affection the inflammation is rarely confined to the pia mater alone, but usually extends to the arachnoid and the internal surface of the dura mater, and even to the cord. It may be caused by exposure to cold and dampness (lying on the damp ground especially); injuries from falls, blows, and concussions; extension of inflammation from other parts. In som instances there may be an extension of inflammation from tl cerebral membranes, or it may occur in conjunction with cer bral meningitis in the epidemic form (*cerebro-spinal menii gitis*). Toxic conditions of the blood, as the result of rheum tism, scarlet fever, typhoid fever, syphilis, etc., may act a causes. Alcoholism and tuberculosis are predisposing cause

Symptoms.—It usually begins with a chill, followed by feve nausea, and vomiting; at the same time there is an intense pai in the back, often referred to the loins, which is aggravate by every movement of the patient, but not usually by pressu on the part of the spine over the diseased portion of the men brane. The pain in the back is usually constant, with exace bations.

Those nerves which have their origin in the affected regio are the seat of a severe, burning, lancinating, darting pai which is transmitted through their trunks and branches t distant parts of the body, and is usually worse at night; the is also hyperæsthesia of the skin in the region supplied by the nerves.

Spasms are usually associated with the pains. Spasms the muscles of the back are the most common; these are ton in character, and may be so slight as to merely cause retra tion of the head or stiffness of the back; or may be so severe a to bend the body backward, producing an appearance like th opisthotonus of tetanus. The other trunk muscles, especiall those of the abdomen, are liable to be involved. At the sam time the limbs below the seat of the lesion become rigid an painful, cramp-like spasms occur in them when they are move in some cases they may become strongly contracted. There i impairment of the motor and sensory power in all those part of the body supplied by the nerves coming from that portion c the cord involved, and also of the regions supplied by th nerves coming from the cord below the diseased region.

The muscles become weak and flaccid and finally paralyzed The sensibility of the parts gradually diminishes and is finall lost. The bowels are usually constipated and there is a tendency to retention of the urine. In the early stages reflex action is increased, but soon gradually diminished, and in the later stages is entirely abolished. The "Cheyne-Stokes breathing" may be present from implication of the medulla.

Diagnosis.—The chill and fever, followed by the severe pains in the back and along the course of the nerves leading out from the seat of the lesion; the hyperæsthesia, the muscular spasm, and exaggerated reflexes; later on paralysis, atrophy, and anæsthesia.

Prognosis.—The prognosis is grave in all cases. Many cases recover completely; others run a course of two or three weeks, ending in death; others still may pass into the chronic stage.

Aconite.—Burning, unquenchable thirst, yet cannot retain anything on the stomach; vertigo; full, strong, hard pulse; great restlessness and great heat of the body; numbness of the mouth and tongue; numbness of the small of the back, extending into the lower limbs; trembling and tingling of the limbs, accompanied by shooting pains; twitching of the fingers and toes; stiffness of the neck. Aconite is especially useful in the acute stage where the affection is due to exposure to cold or dampness.

Apis.—Œdema of the face; eyelids puffed; a sense of suffocation, as if they could never breathe again; stiffness of the back and neck; peculiar and great weakness of the whole back and both sides of the spinal column; stiffness in the small of the back and sacral region; could not take hold of anything; lower limbs feel paralyzed; limbs cold and numb; twitching of the limbs; painful turning inward of the big toes, extorting cries from the child.

Belladonna.—Great restlessness, with sudden startings; convulsive twitchings of the limbs; tonic or clonic convulsions; complete or incomplete paralysis, with or without incontinence of urine; pressive pain externally in the neck, when bending the head backward and when touching the part; painful sensitiveness of the skin to contact.

Cuprum.—Twitching and jerking of the muscles of th extremities; twitching in the hands and fingers; coldness of th hands and bluish appearance of the fingers; great weakness the legs, knees giving way; hyperæsthesia and great sensitiveness of the spinal column, the slightest touch intolerable; stif lame feeling in the back and lumbar region.

Gelsemium.—Lameness and stiffness of the neck; the muscles of the neck feel bruised; dull aching in the lumbar an sacral region; cannot walk, the muscles will not obey the wil loss of voluntary motion; numbness, feeling as if the limbs wer going to sleep; sharp, cutting pains from the back down to th hips; arms become powerless; trembling of the hands whe lifting them up; incontinence of urine. The pulse is feeble an the temperature of the body very much depressed; the expression of the face is heavy, dull, drawing; there is a tendency t paresis of the tongue and a remarkable tendency to close th eyelids.

Nux vom.—Burning, tearing, drawing, lacerating, or bruise pains in the back; sudden stitches in the back when turning with dull pain while sitting; convulsive twitching of singl muscles or of a single limb; spasms with tetanic rigidity o nearly all the muscles of the body, with interruptions of a fe minutes, during which the muscles are relaxed; arms and hand go to sleep; numb, stiff feeling; trembling of the lower limb and stiffness; incomplete paralysis of the upper and lowe extremities, affected as if asleep and heavy as lead; paralyti incontinence of urine from irritation of the lower part of th spine. Excessive hyperæsthesia with increased reflex action are marked characteristics of nux.

Secale.—Violent pains in the back, especially in the sacra region; the most complete anæsthesia, paralysis of the limbs convulsive jerks and shocks in the paralyzed limb; painful contraction of the flexor muscles; paralysis of the rectum and bladder. This remedy is peculiar, in that it has the convulsive twitchings and shocks, painful contraction, tetanic phenomena, complete paralysis side by side with continued and even increased reflex action. This remedy is not only suitable in acute, but likewise, and perhaps still more specifically, in the chronic form of the disease, especially where the cord is involved.

Veratrum alb.—Cold sweat all over the body; vomiting, with cramps in the stomach; great thirst for ice-cold water or craves ice; pulse irregular, very weak, and slow; great debility; heavy comatose sleep; muscles of head too weak to support the head; painful paralytic weakness in the upper and lower limbs; painful cramps in the limbs, worse in bed.

Veratrum vir.—High fever; face haggard; breathing labored; frequent vomiting; great prostration; pulse rapid, feeble, barely perceptible, or an irregular pulse—suddenly increases and gradually decreases below normal; muscles of back and neck contracted, drawing head backward; cramps of legs, fingers, and toes; threatened convulsions.

Chronic Meningitis.

Chronic inflammation of the membranes of the cord may be the sequel of the acute form, or may result from an extension of inflammation from the vertebræ or from the cord; concussion of the spine; exposure to cold; alcoholism; syphilis, or tuberculosis.

The symptoms of chronic meningitis have a wider range than the acute form, and vary according to its location and also as to whether the cord or the nerve-roots are mostly affected.

The pain in the back is not so severe as in the acute form, sometimes amounting only to dull, heavy discomfort; also there is not the same degree of rigidity and contraction of the muscles of the back. The spasms which characterize the acute form are absent or only present to a minor degree. The pain is increased by pressure upon the spines of the vertebræ; by movements. The radiating pain extending along the course and distribution of the nerves is present. The pains are of a sharp, burning, darting character, generally worse at night, and may be accompanied by numbness, tingling, an formication.

In the early stages there may be hyperæsthesia; but later th sensation becomes diminished, or even, in certain areas, lost t touch or pain, or both. (Gowers.)

There are paresis and atrophy of the muscles supplied by th nerves that arise from the affected portion of the cord. Refle action is lost, and there is a tendency to bed-sores. Th sphincters are usually paralyzed. As the disease progresses th cord is liable to be affected by pressure or from an extension the inflammation to the cord, and thus causes paralysis of a the parts below the point of lesion.

For treatment, compare "Acute Spinal Meningitis"; als "Peripheral Paralysis of Spinal Origin."

The Blood-vessels of the Cord.

The principal blood-supply of the cord is derived from th vertebral arteries. The vertebrals give off branches that for the anterior and posterior spinal arteries. These run th entire length of the cord, and are reinforced in their course b branches from the ascending cervicals and thyroid arteries the neck; from the intercostal arteries in the back, and, low down, from the lumbar arteries.

The upper part of the cord is supplied much more freely wit blood than the lower; hence the liability of the lower part the cord to undergo softening, etc., on account of insufficie nutrition.

Dr. Moxin gives the following explanation why the lower pa of the cord is affected more frequently with softening than th upper. He says: "The blood-supply to the spinal cord is carrie out by slender vessels which come from the vertebral arteri within the cranium. There are three of these arteries, one the front and two on the back of the cord; they are very slend and yet have to run along its whole length. No arteries s small as these run so great a length elsewhere in the body, an pressure falls rapidly in minute arteries as the length of pi increases, so that it becomes necessary to reinforce these slender vessels wherever possible; and advantage is taken of the nerve-roots to send up little reinforcing arteries along those. In the part of the cord corresponding to the neck, upper extremities, and trunk, where the nerve-roots are short, they reach and join, and furnish blood to the spinal arteries, so that in this part of the cord every segment of it is supplied with blood from two directions, the anterior and posterior spinal arteries bringing blood from above and reinforcing arteries from below. But when you approach the tip of the cord, the supply from below becomes exceeding precarious, and even apt to fail entirely, because upon the long strands of the cauda equina the small arteries are too narrow and too long to reinforce the cord with any certainty. But, at the same time, the supply from above has to be furnished with greater difficulty than in the upper regions of the cord, because the original spinal arteries are very far away and the reinforcing arteries, even in the lumbar region, have to run considerably longer courses than they had in the cervical region."

Hence we see that the lower part of the spinal cord, which gives off the nerve-supply to the lower limbs and sphincters, is much more weakly organized as to its circulation than is the upper part of the cord.

THE SPINAL CORD.

The spinal cord extends through the spinal canal, from the level of the upper border of the first cervical vertebra (the atlas) to the lower border of the first lumbar vertebra, terminating in a slender gray filament, the *filum terminale,* which is known as the central ligament of the spinal cord and assists in keeping the lower extremities of the cord in position.

This thread-like filum terminale runs down the axis of the sacral part of the spinal canal, and even along the back of the coccygeal bones. The upper part of this filament, according to Professor Turner, is undoubtedly homologous with the spinal cord, though no longer inclosed within the bony canal.

The spinal cord is continuous above with the **medulla.** T cord in the adult is from fifteen to eighteen inches in length a occupies the upper two-thirds of the spinal canal, the low third being filled by the cauda equina.* The cord is kept position by a ligament on each side (ligamentum dentilicur which fixes it at frequent intervals to its sheath (the du mater), and also by the roots of the spinal nerves, passing fro the surface of the cord toward the intervertebral foramin The cord is practically suspended in the cerebro-spinal flu This arrangement serves as a protection against injury fro violence transmitted by means of the spinal column; becau as is well known, a fluid medium distributes force applied to in all directions equally.

The spinal cord is uniformly cylindrical in shape, except the points of origin of the roots forming the ***brachial*** ar *lumbo-sacral* plexuses. Here the diameters are increased giving rise to the cervical and lumbar enlargements respectivel

The cervical enlargement, which is the larger, extends fro the third cervical to the first dorsal vertebra; its greate diameter is in the transverse direction.

The lower lumbar enlargement extends from the lower pa of the eleventh to the lower border of the twelfth dorsal vert bra, its greatest diameter being from before backward. Tl cord is composed of series of segments; each segment giving o an anterior or motor root, and a posterior or sensory, whic unite, forming a peripheral nerve.

The substance of the cord is composed of white and gra matter, the white matter being external. The white matter the cord consists of tracts or columns of nerve-fibers whic have received special names according to their positions an connections.

The gray matter has the appearance of a double crescen presenting two anterior and two posterior cornua (horns), con nected by what is called the gray commissure. In the cente of the gray commissure is a narrow canal, called the central canal of the cord. This is sometimes called the sixth ventricle, or the ventricle of the cord, and is seen most distinctly in the embryo, but also still perceptible in the adult. It is completely inclosed by the gray substance. This canal is in communication above with the fourth ventricle, and it extends below to the filum terminale. That portion of gray matter in front of the canal is called the anterior gray commissure, the posterior portion being known as the posterior gray commissure. In front of the gray commissure is the anterior white commissure.

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* Micromyely is a condition in which the spinal cord is abnormally short or small size; this is a very rare anomaly.

The anterior horns are short and broad (club-shaped), and do not reach the surface of the cord, while the posterior horns are prolonged to the groove into which the posterior roots enter. The gray matter of the anterior horns contains multipolar nerve-cells (motor and trophic) arranged in groups. These multipolar nerve-cells in the anterior horns of the spinal gray matter possess a trophic function. When they are destroyed, the nerve-fibers arising from them, and the muscles also which are supplied by those fibers, undergo atrophy; thus proving that they control the nutrition of the muscles connected with them by means of the nerve-fibers.

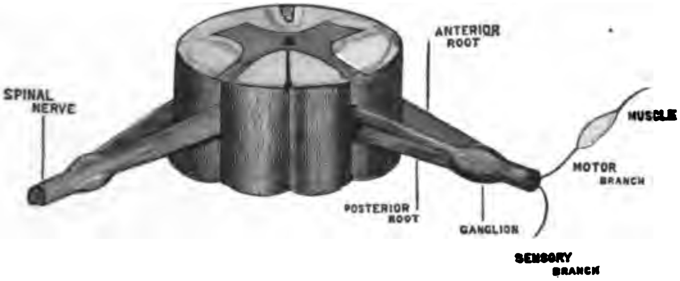

FIG. 42.—A SPINAL SEGMENT. The two roots of the spinal nerve are shown ; also the sensory and motor fibers of which each are composed.

Of the numerous branches of the multipolar cells one is continued as the axis-cylinder of one of the fibers of the anterior roots. The other branches connect together different cell groups, and probably form the medium of communicatio between the cells and the various tracts with which they a in relation. (Ferrier.)

These cells are the means of communication between th fibers that descend from the brain (in the columns of Türck an the crossed pyramidal tracts) and those of the anterior root In other words, they act as a way station between the pyramid tracts of the cord and the anterior roots of the spinal nerves.

The gray matter of the posterior horns contains also som multipolar cells, but of smaller size and more spindle-shape than those of the anterior horns. They are much less numerous and are aggregated in groups.

The gray matter of the cord, viewed longitudinally, forms double column extending through the whole length of th cord. These columns are connected together by the commissure of the cord, thus giving to the gray matter an arrangement somewhat the shape of the letter H.

The cells of the anterior cornua of the gray crescent of th cord are in connection with two sets of filaments—motor an sensory. The gray crescent is, in fact, a small independen brain, responsible to the supreme authority of the encephalon If the connection between the gray matter and the encephalon is severed, all inhibitory control is lost, and any irritation o the peripheral nerves causes a greatly exaggerated action o the parts affected.

The cord presents five fissures: (1) Antero-median; (2 postero-median; (3) antero-lateral; (4) postero-lateral: (5 postero-intermediary.

The antero-median and postero-median fissures divide the cord into two symmetrical halves, which are connected together by the commissure of the cord. The antero-lateral fissure corresponds to the point of escape of the anterior roots of the spinal nerves. The postero-lateral fissure corresponds to the point of attachment of the posterior roots of the spinal nerves.

The postero-intermediary fissure is situated between the postero-lateral and the postero-median fissures.

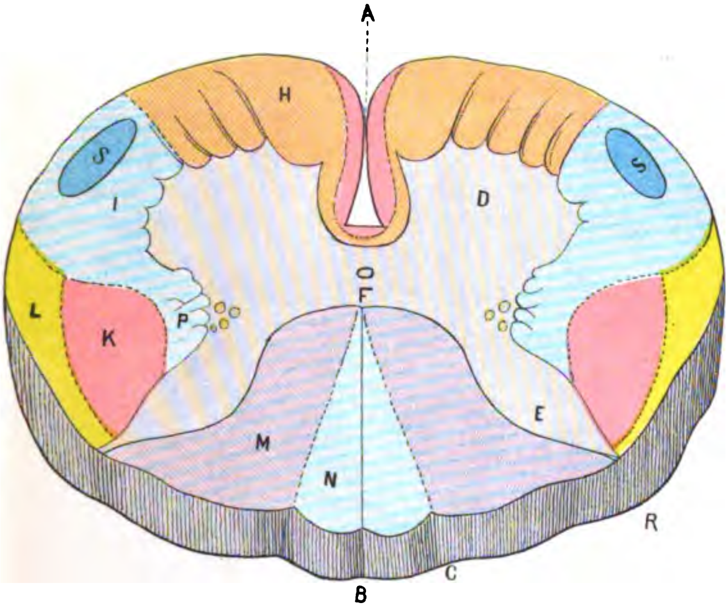

Fig. 43, Plate IX.—A Diagram Representing a Transverse Section of the Spinal Cord and Illustrating the Relations of the Nerve Fiber Tracts in the Spinal Cord.—*A*, anterior median fissure; *B*, posterior median fissure; *C*, intermediate fissure; *D*, anterior gray cornu; *E*, posterior gray cornu; *F*, gray commissure, with central canal; *G*, column of Türck (*direct pyramidal tract*); *H*, anterior root zone; *I*, the remainder of the lateral column after the exclusion of the crossed pyramidal and the direct cerebellar tracts; *K*, crossed pyramidal tract; *L*, direct cerebellar tracts; *M*, column of Burdach; *N*, column of Goll; *Cl*, Clark's vesicular column; *S*, sensory tract of Gowers (a path in the anterior column which undergoes ascending degeneration and is therefore supposed to be associated with sensory functions); *P*, reticular process (bundles of projection which jut out from the gray matter of the cord into the lateral columns of either side between the anterior and the posterior horns).

These fissures divide each half of the spinal cord into four columns: (1) Anterior column; (2) lateral column; (3) posterior column; (4) posterior median column.

The anterior column includes all that portion of the cord between the anterior median fissure and the point of emergence of the anterior roots. Between this point and the attachments of the posterior roots lies the lateral column. Between this and the posterior median fissure lies the posterior column; the posterior median column includes that narrow segment of the cord which is seen on each side of the posterior median fisssure.

These tracts or columns of nerve-fibers are susceptible of a still further differentiation and specialization, and have received special names after certain investigators or from their physiological functions.* These are as follows:

1. The pyramidal tracts, so called because they are directly continuous with the anterior pyramids of the medulla. The pyramidal tract is still further divided into: (*a*) The *direct pyramidal tracts*, or the columns of "Türck," which consist of two narrow columns of white matter, one on each side of the antero-median fissure. These fibers pass from the cerebral hemispheres, through the anterior pyramids of the medulla, to the cord of the same side. According to Ferrier, these fibers cross ultimately by means of the *anterior commissure* of the cord and cease about the middle of the dorsal region. (*b*) The *lateral* or *crossed pyramidal* tracts. These are situated one on either side in the posterior portion of the lateral columns, and are bounded internally by the posterior cornua of gray matter and externally by a narrow band of fibers called the *direct cerebellar* tract. These fibers pass from the cerebral hemisphere, decussate within the substance of the medulla, and pass to the

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* This division of the cord into tracts or columns according to their physiological functions is far superior to the anatomical division, and in studying the diseases of the spinal cord will assist in forming a more accurate and positive diagnosis of certain varieties of spinal lesions. The situation of lesions within the cord can be more easily and definitely described than by using the anatomical nomenclature; hence, when describing the various spinal lesions, this will be the division followed.

opposite side of the cord. The fibers of the crossed pyramida tracts extend to the lower extremities of the lumbar enlargements, where they come to the surface.

The pyramidal tracts (the direct and crossed) ***diminish*** i size from above downward, on account of giving off fibers t the different spinal segments. These fibers finally terminat in the large motor cells in the anterior horns of the spina cord, each fiber being connected with several of the spinal cells These tracts are motor in function, and are the paths for th voluntary motor impulses which are sent out from the brain t the extremities and the trunk.

These tracts have their trophic center in the motor area o the cerebral cortex, and any lesion which tends to sever thes fibers from their center creates a descending degeneration o all the nerve-fibers so disconnected, as far as their ultimate distribution—namely, to the segments of cord below the lesion (Ranney.)

It should be noted that degeneration takes place in the *direction* the *impulse is conveyed*. The result of this degeneration is wasting of the nerve-fibers, followed by an overgrowth of connective tissue, giving us, in general terms, sclerosis.

A lesion of the fibers composing these tracts may cause spasms, paresis, or paralysis, but never any sensory symptoms, as numbness, formication, anæsthesia, or hyperæsthesia.

An irritative lesion, as from meningitis or from tumors pressing on the cord, if located near to or below the third lumbar segment, will cause the patient to lie with the thighs drawn up and the legs flexed.

A lesion of sufficient degree to sever the tracts from their cerebral connection will be followed by complete paralysis of motion of the parts of the body below the seat of the lesion on the same side of the body—hemiplegia.

Contracture of a limb following paralysis, with an exaggeration of the tendon reflexes, is indicative of a lesion involving the lateral pyramidal tracts. In paralysis due to a lesion of the pyramidal tracts there is very little atrophy of the muscles, only

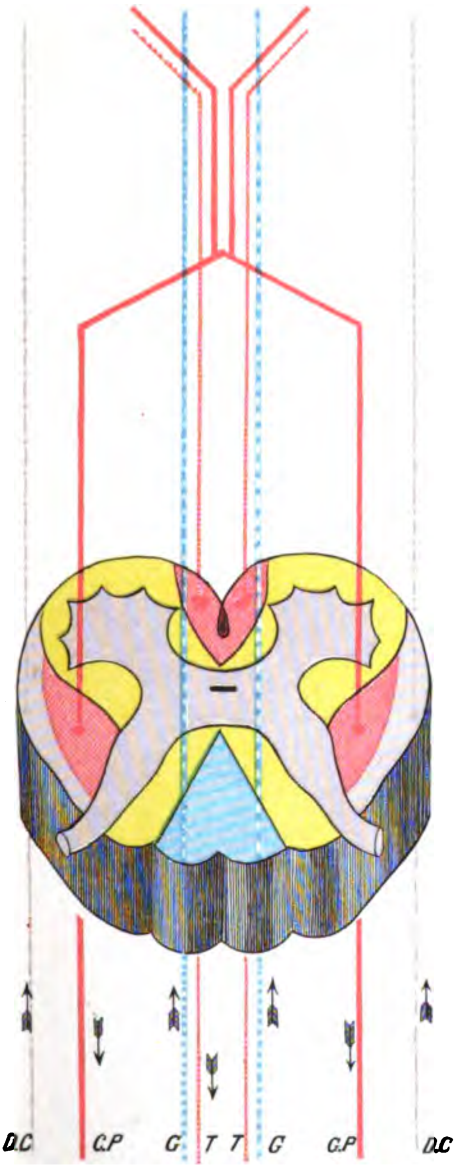


Fig. 44, Plate X.—A Diagrammatic Representation of the Conducting Tracts of the Spinal Cord.—(Ranney's Modification from Bramwell). *T*, fibers of Türck's column (direct pyramidal bundle); *C. P*, "crossed pyramidal fibers"; *G*, fibers of the column of Goll (postero-medium column); *D. C.*, fibers of the "direct cerebellar column." Note that the arrows show the direction of the impulses carried by each tract of fibers; also that the motor fibers of the lateral column decussated at the *lower part of the medulla*. Each of the "anterior pyramids" of the medulla is composed of the motor fibers (direct and decussating) above the lower limits of the medulla.

such as would naturally be the result of disease of the limb.

In a lesion of the brain of sufficient degree to cause hemiplegia the parts, as a rule, are paralyzed on the opposite side of the body from the seat of the lesion, on account of the crossed pyramidal tracts containing the larger part (three-fourths) of the motor fibers; but in a rare case the paralysis may be on the same side of the body as the lesion. This is due to the fact that the direct pyramidal tract (column of Türck) contains the greater number of the motor fibers.

The origin of the pyramidal nerve-fiber is in the cortical motor area of the cerebrum; it terminates in the large motor cells of the spinal cord. Each pyramidal fiber being connected with several of the spinal nerve-cells, and as each spinal nerve-cell is the origin of a spinal nerve, this gives a pyramidal fiber control of several spinal fibers, and it is thereby enabled to control a larger variety of movements. (Gowers.)

Paralysis of motion and muscular atrophy, when due to spinal lesion, develop upon the same side of the body as the lesion. This is due to the fact that the motor fibers do not cross over until they reach the medulla.

Sclerosis of the lateral columns always increases the deep or tendon reflexes.

Exaggerated tendon reflexes, contracture, and hasty micturition are indicative of a lesion of the pyramidal tracts. Foot-clonus is almost always a positive sign of a lesion of the pyramidal tracts.

2. The direct cerebellar tracts are two narrow bands of nerve-fibers situated at the outer and posterior portion of the lateral columns, external to the crossed pyramidal tracts. These columns make their appearance in the lumbar region of the cord (lowest dorsal and first lumbar nerve), increase in size from below upward, and reach the cerebellum by the inferior peduncles. These fibers originate in the vesicular columns of Clark. Flechsig advances the theory that these columns conduct centripetal impressions from the muscles of the lower part of the trunk to the co-ordinating mechanism in the cere-

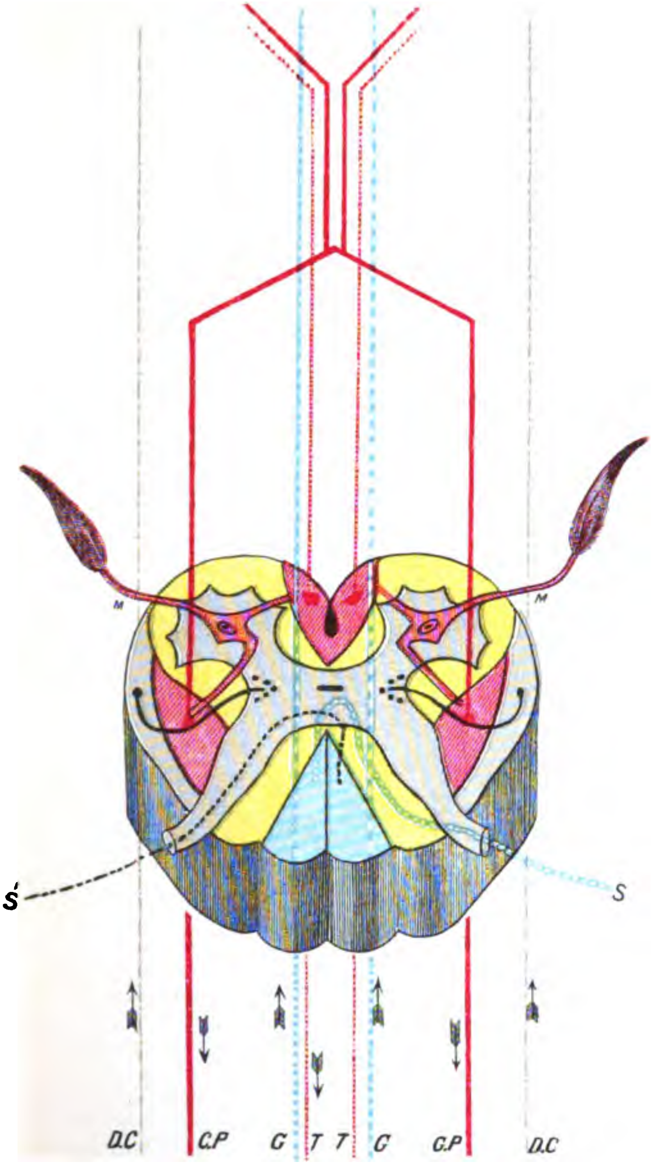
bellum. Starr is of the belief that the direct cerebellar trac are in some way associated with the transmission of viscer sensations from the thorax and abdomen, through the cor to the higher centers—probably the cerebellum.

The function of the remaining part of the anterior and later columns after the exclusion of the pyramidal and direct cer bellar tracts is not well understood, yet there seems no reaso to doubt that the lateral columns contain paths of sensatio

That portion lying anterior to the anterior roots of th spinal nerves (anterior root zone) appears to contain fibe which serve to connect the different segments (commissur fibers) with each other; not merely those on the same side, bu in part also those of the other side, by means of the anterio commissure. The relations of the lateral portions are mor complicated; aside from containing fibers which connect th different segments together, it seems to be the path which th vasomotor and inhibitory fibers travel. Gowers suggest that possibly it contains the paths for tactile sensibility, fo sensibility to pain, and for sensations of temperature.

3. The columns of Goll (posterior median columns) are tw wedge-shaped columns lying on each side of the postero median fissure. These columns begin in the middle dorsa region and increase in size from below upward. Thes columns seem to be the path through which tactile sensation are conveyed from the lower extremities upward to the brain It is also claimed that anatomical researches show that thes columns are formed by the sensory fibers which come from th perineal region.

4. Burdach's column, the remaining portion of the posterio column after the exclusion of the columns of Goll. Thi column is formed mainly of fibers derived from the posterio roots of the spinal nerves. These fibers enter the cord, travers it for a short distance, and then pass inward to join the gray matter of the cord. There are also commissure fibers which connect different segments of the cord together, and there are also numerous bundles of longitudinal fibers. The columns



G. 45, PLATE XI.—A DIAGRAM DESIGNATED TO ILLUSTRATE THE CONNEC-
S OF THE MOTOR AND SENSORY CONDUCTING TRACTS OF THE CORD WITH
SPINAL NERVES.—(Modified from Bramwell.) *M*, motor fibers of the an-
r root of a spinal nerve; *S*, *S'*, sensory fibers of the posterior root. It
be observed that the course of *S* and *S'* are not the same. Some sensory
s pass directly through the posterior horn of the spinal gray substance,
others through Burdach's column to reach the gray substance. The
ct cerebellar column is composed of fibers which start in Clark's column
ells. The fibers of the two pyramidal tracts become united to the motor
in the anterior horns of the spinal gray substance.

rdach appear to be associated mainly with the conveyance tile impressions from the upper limbs to the brain.

r knowledge of the sensory path of the cord is far less te than that of the motor path. By experimental investi- n it has been definitely ascertained that the motor fibers y the anterior portion of the cord. It is not so easily nstrated by experimental investigation what portion of ord is traversed by the sensory paths as in the case of the r, but yet, by comparing the knowledge that can be ned from that source (experimental) with that obtained clinical cases in diseases of the cord, it can be pretty defi- stated that the posterior columns are the sensory paths the periphery to the brain.

sions of the sensory tracts (columns of Burdach and Goll) t induce paresis, paralysis, spasm, or muscular atrophy, re manifested by sensory symptoms, such as anæsthesia, æsthesia, numbness, formication, abnormal sensation of and cold, and by ataxic symptoms (inco-ordination). teral lesions of the spinal cord, which cause loss of sensi- of the skin, do so on the side opposite to the lesion; thus ng that the nerves of common sensibility, of touch, and of emperature cross over in the spinal cord.

itative lesions of the posterior columns (columns of ach and Goll) cause the condition known as the girdle or cincture feeling in those nerves that traverse the sed area of the cord. Below the level of the spinal lesion, ctive sensations of touch (such as formication, numbness, mal sensations of heat or cold, etc.) and more or less æsthesia are created. (Ranney.)

hen there is a girdle pain without any impairment of the of touch in parts below it, or the presence of motor ysis, it is strongly indicative of a lesion involving the pos- nerve-roots only.

structive lesions of the posterior columns are followed by thesia of the parts supplied by the nerves coming from the l segments affected by the lesion.

Sensory phenomena are manifested upon the side of the boc opposed to the seat of the lesion. This is on account of tl sensory fibers decussating in the cord.

Sclerosis (hardening) of the posterior columns abolishes tl reflexes.

Schiff has shown that in the spinal cord the white posteri columns possess the property of conducting tactile impression and that pain can be transmitted only by the gray substanc

The posterior columns are also supposed to contain the mu cular sense nerve-fibers.

The columns of Burdach and of Goll are generally affecte together by primary disease, but not always to the sam extent. They may, however, be affected independently b diseased processes.

5. There is a group of multipolar cells (smaller than thos of the anterior horn) situated at the inner side of the posterio horn, known as "*Clark's vesicular column*." These cells formin Clark's column do not extend as a continuous column through out the whole length of the cord.

It is most distinctly outlined in the lower dorsal and uppe lumbar regions, but may be found continuously as high as th seventh cervical nerve. (Ferrier.)

Homologous groups, more or less detached from the con tinuous column, are described as occurring as low as the origi of the second or third sacral and as high as the third cervical (Stilling.)

Gaskell traces their homologues in the cells forming th nucleus of the vagus.

The columns of Clark are supposed to contain the vasomotor and trophic fibers.

6. Gowers' column. A path in the anterior column which undergoes ascending degeneration, and is, therefore, supposed to be associated with sensory functions (centripetal).

By some writers it is claimed that the destruction of the tract fibers of Clark and Gowers, which lead to the cerebellum, causes loss of co-ordination.

ıen the motor centers of the cerebral hemispheres are
ɔyed, or the tracts leading from them are severed,
ıeration proceeds *downward* exclusively in the pyramidal
; thus showing conclusively that they are the paths (cen-
al paths) through which motor impulses are sent out from
rain to the periphery.

ıen the cord is severed, *ascending* degeneration takes
in the direct cerebellar tracts, the columns of Burdach and
These tracts are therefore undoubtedly centripetal
, whatever views may be entertained in reference to their
functions and the value of the impressions they convey.

ıen a hemisection of the cord is made, paralysis of volun-
motion occurs on the side of the lesion and paralysis of
tion on the opposite side.

cording to its functions, the cord may be divided into parts:
ı anterior, which includes the pyramidal tracts and the
ior horns of the gray matter, and is the probable path of
otor impulses which traverse the cord as well as the seat
ɔphic influences upon the tissues; (*b*) a posterior, which
les the posterior and cerebellar columns and the posterior
, and is the probable path of the sensory impulses, while
also associated with the functions of co-ordination of
ment.

ıen, as a consequence of disease, the continuity of the
is completely interrupted at any point, there is complete
ysis of sensation and of voluntary motion below the point
ion, but the reflex excitability of those parts below the
is greatly increased.

is is due to the fact that when the spinal centers are com-
y dissevered from the cerebral, their activity is more
y excitable than under normal conditions. (Ferrier.)

Functions of the Spinal Cord as a Whole.

a whole, the spinal cord serves as a pathway for the con-
on of motor impulses from, and for sensory impulses to,
rain.

From a physiological standpoint, it may be regarded as co posed of numerous segments which are superimposed; each which is capable of automatic action. The segments of cord are controlled, when necessary, by the brain. When t controlling power is interrupted from any cause, as in spi lesion, for example, the spinal segments still continue to automatically.

Within some of these segments are placed special reflex a trophic centers, which govern the action of the viscera, sex organs, and the caliber of the blood-vessels.

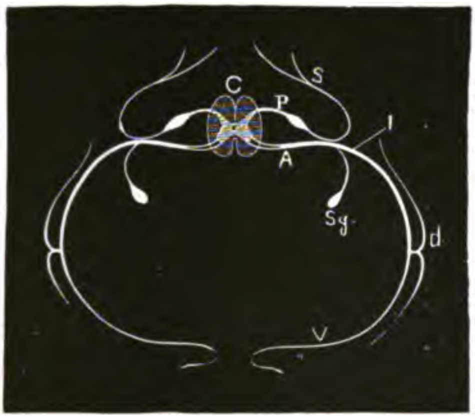
The principal reflex centers are: (1) The *cilio-spinal cent* This center is located in the lower cervical and upper dor (according to Ferrier, at the level of the second dor nerve) region of the spinal cord, and it is from this center tl the fibers of the cervical sympathetic, which cause dilatati of the pupils, originate. (2) The *visceral center*, which co trols the functions of the bladder and rectum, is located in t lumbar enlargement. Although these organs are under t immediate control of the sympathetic system of nerves, th are related to centers in the spinal cord, and it is from the centers that the controlling influence is really derived. (The sexual or *genito-spinal center* is situated in that portion the cord corresponding to the fourth lumbar vertebra. Fara zation of this center causes powerful contractions of the va efferentia, the bladder, and the lower portion of the rectum. (*Vasomotor centers.* The cord also contains centers whic in connection with the sympathetic system, control the to of the blood-vessels. The chief center of vascular innervatio however, is in the medulla oblongata. (5) *Trophic cente* The trophic centers for the muscles are located in the gray ma ter of the anterior horns; while that of the skin, joints, cellul tissue, and the bones is located in the posterior horns and tl ganglion of the posterior roots.

The Spinal Nerves.

The spinal cord gives off thirty-one pairs of nerves, calle spinal nerves, in contradistinction to those of cranial origi

pinal nerves are divided into groups; namely, eight cervi-
velve dorsal, five lumbar, five sacral, and one coccygeal.
nerve arises from the spinal cord by an anterior (motor)
posterior (sensory) root, the posterior root being the
and possessing a ganglion.

: two roots pass through the membranes of the spinal
it different points and unite into a single mixed nerve,



46.—REPRESENTING A SPINAL "ARC"—that is, a spinal segment with its pair
s. (Horsley.) C, the spinal segment; Pr, the posterior root; ar, the ante-
; SPD, IPD, branches of the compound nerve; Sg, the sympathetic ganglion;
ral termination of nerve.

passes out of the spinal canal by the intervertebral fora-
The nerve thus formed contains both motor and sen-
fibers. Each nerve at its exit from the intervertebral
ien divides into an anterior and a posterior division.

e anterior division, the larger of the two, supplies the
and all parts in front of the spinal column. The pos-
division supplies the posterior part of the body. Each
on sends to and receives small filaments from the sympa-
: nerves, thus bringing the cerebro-spinal system and the
athetic system in direct communication with each other.

e posterior branches of the spinal nerves are very simple in
distribution. With the exception of the second cervical

and the lower sacral nerves, these nerves pass backw
divide into external and internal branches, which are distribu
to the muscles and integument behind the spinal column.

The Upper Cervical Nerves.

The upper cervical nerves (first four of the spinal ner
supply motor power and sensation to the muscles and inte
ment of the neck above the clavicle; and also sensation to
back of the head and ears. They divide into anterior and p
terior branches. The anterior branches of the four up
cervicals unite to form the *cervical plexus,* thus supplying
anterior and lateral part of the neck with sensation and moti

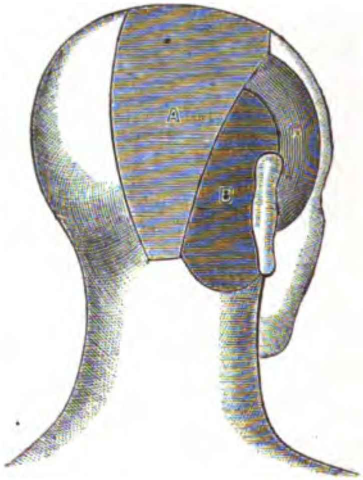


FIG. 47.—SHOWING THE NERVE SUPPLY OF THE POSTERIOR PART OF THE HE
(After Hilton.) A, region supplied by the great occipital nerve; B, region supp
by the small occipital nerve; C, region supplied by the auriculo-temporal nerve.

and sending filaments of communication to the pneumogastr
the hypoglossal, the spinal accessory, the fifth nerve, and
the sympathetic nerves. The posterior branches supply t
muscles and skin of the back of the neck and the occiput.

The more important branches of the upper cervicals are:

1. The *great occipital* (the posterior division of the seco

al), which supplies sensation to the greater portion of tegument of the scalp, from the neck to the vertex of the m. This is the nerve that is chiefly affected in neuralgias occipital region (cervico-occipital neuralgia).

The *small occipital* (the anterior branch of the second al), which supplies sensation to the lateral and lower tal region.

The *communicans noni* nerve (arising from the second and cervical nerves), which, together with the descendens forms the loop from which filaments are given off to the muscles (sterno-thyroid, sterno-hyoid, and omo-) which depress the larynx and the hyoid bone.

The *phrenic nerve*, sometimes called the "internal respira- erve of Bell." This nerve arises by three heads from the fourth, and fifth cervical nerves, and is distributed to the *surface of the diaphragm*, a few filaments passing to ericardium. This is the motor nerve of the diaphragm. rding to Luschka and Henle, it also possesses sensory Lesions of this nerve may cause: (*a*) Clonic spasm of aphragm (hiccough); (*b*) neuralgia of the diaphragm; (*c*) sis of the diaphragm.

Diseases of the Upper Cervical Nerves.

vico-Occipital Neuralgia.—In this affection the pain is ly located in the occiput at the point where the great tal nerve escapes between the mastoid protuberance and rst cervical vertebra. Another point where the pain may cated is over the parietal protuberance where the frontal hes of the fifth nerve meet those of the occipital nerve.

e chief remedies called for in this affection are gelsemium, ia, nux, spigelia, sanguinaria, and sepia. For the indica- of these remedies, see "Headaches."

ccough.—Hiccough is a clonic spasmodic disorder of the ic nerve. As a general thing, it is only of short duration, n some instances it may continue for hours, days, or even short periods of respite) for weeks. When persistent,

it may cause death from exhaustion. It may result from dir
irritation of the phrenic nerve by tumors of the mediastinu
aneurisms, pneumonia, pleuritic effusions; from central caus
such as hysteria and emotional excitement. Most cases of h
cough, however, are of reflex origin, the stomach, intestin
liver, kidneys, or uterus being the source of irritation. H
cough may be a symptom only of minor importance, or m
indicate lesions of a grave character.

Treatment.—The milder forms may be relieved by swallo
ing cold water, pieces of ice, acid drinks, or a lump of sugar w
a few drops of vinegar on it. A bandage bound tightly arou
the base of the thorax will often control it. Persistent holdi
of the breath is frequently successful in producing reli
Inhalation of chloroform or ammonia will often check it.

It has been recommended to lay the patient supine over
thick bolster, so that the head hangs down and the thor
arches up. Galvanizing the phrenic nerve will often relie
cases in which all other treatment has failed.

Veratrum vir.—Constant hiccough, with constant spas
of the esophagus; frequent and long-continued hiccough; wi
a constant sensation as if a ball were rising in the throat.

Dioscorea.—Sharp, cramping pain in the pit of the stomac
followed by belching and gulping of enormous quantities
tasteless wind, which is followed by hiccough and discharges
flatus from the bowels.

Ambra grisea.—Violent, spasmodic hiccough, aggravated
warm drink. Especially useful in hysterical females.

Bryonia.—Hiccough after eating, and every effort caus
pressure in the forehead, as if the brain shook from behind.

Ignatia.—Hiccough after violent mental excitement; aft
eating or drinking; from smoking; spasmodic hiccough occu
ring periodically every afternoon and lasting for hour
Especially useful in children.

Hyoscyamus.—Hiccough after meals; hiccough with spas
and rumbling in the abdomen; hiccough the result of inflam
mation of the intestinal organs. Hyoscyamus is one of ou

emedies for hiccough occurring after operations in the ıen.

c vom.—Hiccough frequent, violent; after hot or cold ; from overeating. Nux is one of our best remedies in ate cases of hiccough.

ıricus.—Hiccough alternately with belching; eructations of rotten eggs; accompanying hiccough there are burning in the region of the heart.

ic acid.—Eructations of burning, hot gas from the ch, causing a profuse secretion of tenacious mucus, must be continually hawked up; eructations of hot, acrid which burn from the stomach to the throat.

ı.—Hiccough during sleep.

ımonium and *veratrum album* for hiccoughs after hot , and *arsenicum* and *pulsatilla* after cold drinks.

ıralgia of the Diaphragm.—Neuralgia of the diaphragm rily may be due to cold and exposure or anæmia; darily to diseases of the heart and vessels, Basedow's e, angina pectoris, and to diseases of the liver.

pain is of a sharp, lancinating character, more or less ıuous, and usually confined to the left side, beginning at ıse of the thorax, at the insertion of the diaphragm, and ing upward to the shoulder and neck; it is aggravated respiratory movements of the chest.

nite.—Stitches through the apex of the scapula, aggravated by every respiration; breathes anxiously, quick and ficial; pulse quick, hard, and small; dry burning heat of great thirst and restlessness; numbness of the left can scarcely move the hand; tingling of the fingers. ially useful in neuralgia from exposure to cold.

aricus.—Cardiac pain and dyspnœa, increased by walking, continued pressure at the pit of the stomach; great precordial anguish, with paralytic pains in the left arm, neck, and of neck.

yonia.—Stitching pain in the region of the diaphragm, from motion or coughing; tearing stitches in the left side of the chest, extending through the front, to the shoul blades; stitches in chest and sides of chest; especially w coughing or drawing a long breath, obliging one to sit up lie on the back; worse from motion.

Belladonna.—Sudden, violent, stinging, cutting pains; co on suddenly, continue violent for a longer or shorter time, disappear as suddenly as they came; short, hurried, anxi breathing; tightness, oppression or constriction of the ch

Phosphorus.—Stitches in various parts of the chest, especially on the right side, worse from breathing, better w lying on the right side; burning, cutting pain; pressive sen tion about the heart; dyspnœa and tightness across chest.

Rhus tox.—Stitches in the chest and sides of the che especially when sitting bent, sneezing or taking a long brea tension across chest; breathing short; great anxiety, w weight on lower portion of chest; pain in chest as if the stern were pressed inward; pains worse in damp weather. Especia useful when the pains are brought on by exposure to cold dampness.

Ignatia.—Persons mentally or physically exhausted by lo concentrated grief; lancinating stitches as from a sharp kni

Cuprum.—Sudden attacks, attended by intense dyspno faintness and slight convulsions; surface of body cold and bl

Cactus grand.—Continuous palpitation of the heart, bo day and night; worse when walking, at night, and when lyi on the left side; sensation as if the heart was grasped by an ir hand, preventing movement.

Spongia.—Cramping pain in the heart, with great angui in the chest; extreme oppression of breathing, with feeling suffocation; sudden pain and pressure within the chest, wi anxiety; face pale; nausea; lower part of the body feels num upper part sore and body bruised.

Paralysis of the Diaphragm.—The diaphragm is rare paralyzed, but may be from extension of inflammation from t peritoneum, pleura, or pericardium; from disease or injury the cervical cord; from injury to the phrenic nerve; fro

y; from mediastinal tumors; from rheumatic and toxic
ices. It is often paralyzed just before the fatal termina-
f progressive muscular atrophy. The paralysis is usually
al.

re is little or no movement of the diaphragm when it
ilyzed; consequently breathing is interfered with. The
haracteristic feature is depression of the epigastrium and
hondrium during inspiration. The liver tends to rise in
est, during inspiration, rather than to be displaced down-
into the abdomen. The respirations become slow and
lt, but are not, as a rule, hurried so long as an affected
i is quiet, but upon exertion may be increased to forty or
ixty per minute. The voice is usually enfeebled and may
irely lost.

prognosis is bad. Treatment avails very little. It has
ecommended to faradize the diaphragm or galvanize the
ic nerve.

The Lower Cervical Nerves.

was the case with the upper cervical nerves, the lower are
d into anterior and posterior divisions as soon as they
e from the spinal foramina. The posterior divisions
y the muscles and integument in the region of the spine,
lower part of the neck. The anterior divisions of the
ower cervical nerves, together with the greater portion
e first dorsal nerve, unite to form the *brachial plexus.*
brachial plexus is broad at its commencement, narrow
site the clavicle, and in the axilla it expands again and
es into numerous branches, which are distributed to the
der, upper extremity, and a few filaments (anterior
cic nerve) to the integument and muscles of the upper
of the chest. The more important branches are:

The *musculo-cutaneous nerve,* which is distributed to the
o-brachialis, biceps, and part of the brachial anticus, and
e integument down to the wrist. This nerve is hardly
paralyzed alone, but often suffers with other nerves in
se of the brachial plexus.

2. The *median nerve,* so called from the course it takes al the middle of the arm and forearm to the hand, lying betw the ulnar and the musculo-spiral and the radial nerves. In course along the arm it gives off no branches, but passes do ward, and is distributed to the superficial muscles of the fo arm (the pronators, the radial flexors of the wrist, the fl ors of the fingers, except the ulnar half of the deep flex and the integument of the palmar surface of the hand. T nerve, in connection with its fellow, the ulnar nerve, furnis motor power to all the flexor and pronator muscles of the fo arm, and all the muscles of the palm of the hand. (Rann Hilton says that these two nerves, median and ulnar, suppl the flexors of the wrist-joint, fingers, and thumb, all the p nators of the radio-ulnar joint, and all the joints that th muscles move.

3. The *ulnar nerve,* which passes along the inner side of arm and is distributed exclusively to the muscles and inte ment of the anterior surface of the forearm and the pal surface of the hand. This nerve, in conjunction with median, supplies motor power to the flexors and pronators the wrist and flexors of the fingers.

4. The *circumflex nerve,* which is distributed to the musc of the shoulder, chiefly to the deltoid, to the integument of shoulder, and to the shoulder-joint.

5. The *musculo-spiral nerve,* which is the largest branch the brachial plexus. It is the great extensor nerve of the fo arm and hand. It arises from the posterior cord of brachial plexus in common with the circumflex nerve; pass behind the axillary and brachial arteries, it winds around humerus and the musculo-spiral groove, giving off branches the muscles and integument of the back part of the ar passing on down, it divides into several branches (chief amo these are the radial and posterior interosseous). It supp the triceps, all the muscles on the back of the forearm, extensors of the wrist and fingers, and both the supinators; a the skin on the radial side of the back of the hand, the back the thumb, index finger, and half of the middle finger.

Diseases of the Lower Cervical Nerves.

he *median nerve* is occasionally the seat of neuritis from pression. It frequently escapes in neuritis or injury of the hial plexus. In paralysis of this nerve pronation of the arm is almost wholly abolished. The hand can be flexed toward the ulnar side.

he terminal phalanges of the fingers can no longer be ed. The patient can grasp an object only by the last three ers. (Leszynsky.) The thumb cannot be flexed or osed, and usually lies on the hand.

n paralysis of the *ulnar nerve* flexion of the hand is per- ned imperfectly, the fingers cannot be separated from each er; the little finger cannot be moved at all, and it is impos- to press the thumb firmly against the index finger. lysis of this nerve may cause the condition known as "claw l."

aralysis of the *circumflex nerve* may be caused by dislo- on of the humerus, falls on the shoulder, pressure of a ch, simple neuritis, and from diseases of the brachial plexus. chief symptom is paralysis of the deltoid. The arm can- be elevated or rotated outward.

he *musculo-spiral nerve* is more frequently paralyzed alone any other nerve of the arm. Its position exposes it to y from fracture of the humerus, dislocations, pressure from utch, and from temporary pressure during sleep, especially unken sleep. This is the nerve that is chiefly affected in paralysis, neuritis, especially in poly-neuritis, and in cere- hemiplegia.

esions of this nerve, when high, may result in paralysis of he extensors; the hand hangs down relaxed in a flexed tion and cannot be raised or extended; the thumb and index er cannot be extended or abducted. When the hand is upon a table, it cannot be raised or supinated. The lateral ements of the fingers can be performed as in health, since e movements are controlled by the interossei muscles.

Paralysis of this nerve causes the well-known deformity kno as " wrist-drop."

Brachial Neuritis.—All the nerves entering into the forn tion of the brachial plexus may be the seat of a prima neuritis. This may be the result of exposure to cold a dampness, or may result from rheumatism, gout, or injuri

The pain in brachial neuritis is greater than in most forms neuritis. The pain may be located at the plexus or referred other parts, as the wrist or back of the forearm or in the regi of the scapula, the chest, or neck, or it may extend along t course of the different nerves. It is usually of a lancinatii stabbing, or burning character, and aggravated by motio especially any attempt to elevate the arm. The pain may severe from the beginning, but usually comes on gradually wi intermission, but as it increases it becomes more continuou Later on there is a dull, wearying pain in the whole ar especially in the region of the plexus, varied by attacks of gre severity. There may be a tingling or pricking sensation of tl skin of the whole arm. Occasionally there is anæsthesia the distribution of the nerve chiefly affected. The muscl present a flabby condition, with only a slight wasting, as tl damage to the motor fibers is seldom sufficient to cause general atrophy.

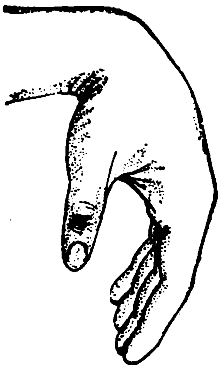


FIG. 48.—SHOWING POSITION OF HAND IN WHAT IS CALLED " WRIST-DROP."

:hial Neuralgia.—In the main, the causes, symptoms, ·eatment are the same as in brachial neuritis. Many of supposed neuralgia are really cases of neuritis.

atment.—For the treatment of paralysis of this group of :s, see "Peripheral Paralysis." Those forms of paralysis › cerebral lesions will be treated under the heading of bral Hemorrhage and Paralysis in General."

nite.—Unbearable pains, especially at night, lancinating ulsating pains; restless, moaning, great anguish, great redness of the cheeks; pulse small and quick; numbness, ıg and formication of the limbs; trembling and tingling limbs, accompanied by shooting pains; drawing, tearing n the limbs; arms hang down as if paralyzed with heavy

ica.—Stinging and pricking in the affected parts, with sness, so that he has to stir about constantly; worse from or from the slightest exertion; violent, twitching pain :he shoulder-joint to the fingers; arms feel weary, as if d by blows; pains in arms and hands; twitching of the :s; convulsions and tetanic spasms consequent upon nical injuries; paralysis depending on extravasation of in the brain.

adonna.—Lancinating, burning pains, aggravated by n, shock, or contact; lancinating pains, with pressure in ıoulder, darting suddenly along the arm; particularly l at night; violent stabbing, as with a blunt knife, below ead of the humerus, from within out; numbness and ng in the hands; twitching of the arms; painful jerking; t redness of the arms and hands; heaviness and a paralytic ; in the upper limbs.

onia.—Pressing, tearing, shooting pains, worse from n, better when lying on the affected side; tearing in the ler-joint and upper arms, with tension and stitching; arts are red and swollen; painful pressure on the top of ıoulder, worse upon touch; on deep breathing it becomes stitching, which extends downward and outward to the shoulder-joint; tearing pains on the inner surface of the for arm, in a line from the elbow to the wrist. Especially useful rheumatic neuritis.

Dulcamara.—Stitching, drawing, and tearing pains in th limbs after an acute eruption or after catching cold; worse night; sensation as if the limbs were going to sleep; paralys of the arm, with icy coldness; loss of sensation; paralysis fro suppressed eruptions and from exposure to intense col and wet.

Causticum.—Lameness, weakness, and a flabby condition the muscles of the arm; griping, clawing as from a band aroun the elbow, better from warmth; painful numbness of the thum and index finger, appear as if they were larger, especially whe touching something; fingers half closed, cannot move the except with the other hand; contraction and induration of th tendons of the fingers; paralysis of the upper extremitie paralysis caused by exposure, or from suppressed eruption paralysis of the deltoid; cannot raise the hand to the hea Causticum is especially useful in paralysis of single nervo trunks; more useful in paresis than in complete paralysis, an where the sensibility is only slightly, if at all impaired.

Plumbum.—Convulsive motions of the arm and hand, wit pains in the joints; weakness of the arm, with atrophy; loss sensation and trembling; weakness and painful lameness of th arms; paralysis of both motion and sensation, followed by wasting of the muscles; paralysis affecting the extensors mor than the flexors; wrist-drop.

Cuprum.—Convulsive twitching of the arm and hand; coldness of the hands, and a bluish appearance of the finger Cuprum is especially indicated where the motor power is chiefl affected, sensation being very little impaired.

Rhus tox.—Tingling, burning pains in the limbs; great weakness in the limbs; drawing or tearing pains in the limbs durin rest; better on motion; pains as if bruised, or sprained in joints lameness with tearing, tingling, and numbness; numbness in th extremities, with previous twitching and tingling in them sis of the limbs with numb sensation; paralysis from getting or lying on the damp ground. Rhus is especially useful in matic paralysis.

acardium.—Sensation of weakness in arms, with trem- numbness of the fingers; wave-like twitches through parts; tensive pain in the arm; sensation as of a hoop or around the parts.

aris quod.—Feeling of great weight on the nape of the and shoulders; violent pains on both sides of the neck, nding down to the fingers; especially on the left side.

ux.—Cervico-brachial neuralgia; neck stiff, worse in morn- and after eating, and from touch; neck stiff, with heaviness; matism of the muscles of neck, with or without tear- drawing pains; head generally drawn to one side and moved great difficulty; tension and aching between shoulder es; burning, pressing as from a stone or stitches; burn- tearing, drawing, lancinating, or bruised pains in back; lder pains as if bruised; paralytic heaviness, with weak s; drawing in arms, extending from shoulder to finger, with ation as if the arm were asleep; loss of motion of the arm.

lectrical treatment will prove of great benefit in these vari- affections. If it is a neuritis, the galvanic current will be erable; the positive pole placed at some indifferent part of body, the nape of the neck usually, and the negative pole lied over the inflamed nerve and its ramifications. In the r stages or in case of paralysis, one electrode is to be applied point above the seat of the injury, and all the affected mus- are then made to contract separately. In many of these s beneficial results may be obtained by using the interrupted anic current. For anæsthesia the faradic wire brush is erable to any other line of treatment. When the paralyzed scles do not react to faradism, and nerve degeneration is sent, its persistent use is liable to aggravate the case by ngthening the opposing or non-paralyzed muscles, and s hastening deformity by overaction of these muscles.

n case of long standing of paralysis of the ulnar nerve, where the hand has assumed the characteristic position kno as “ claw-like hand,” nothing can be done.

The Dorsal Nerves.

The dorsal nerves, with the exception of the first and la do not enter into the formation of plexuses, but immediat after their escape from the vertebral foramina divide into p terior and anterior branches.

The posterior divisions supply the muscles and integume of the back.

The anterior divisions supply the muscles and integume of the thorax and abdomen; the six upper branches are d tributed to the chest exclusively (muscles, integument, a pleura), and the six lower branches to the lower part of t thorax and abdomen.

The first six dorsal nerves contain fibers which enter t sympathetic and supply the pleura and lungs. Fibers from t last six enter the sympathetic and supply the pelvic visce (Dana.) The upper six dorsal nerves are mainly inspirator function, while the lower six are expiratory nerves.

Each dorsal nerve is connected with a sympathetic gangli by two short filaments, thus bringing the cerebro-spinal a sympathetic systems in direct communication.

Diseases of the Dorsal Nerves.

Pain in connection with the dorsal nerves is a more valuab guide than in almost any other portion of the body. A pe sistent pain confined to the surface of the body in the region the chest, back, or abdomen, where there is no evidence of lo inflammation, is indicative of disease of the spine or of so of the organs or structures somewhere in the course of t nerve between its spinal origin and its cutaneous terminati for example, inflammation of the pleura may be accompani by pain and tenderness of the skin in the region of the axil over the front of the shoulder, and down the inner side of t arm. This is due to pressure upon filaments of the intercost during their passage through the walls of the chest to eripheral distribution (the axilla, shoulder, and arm), by rbid condition of the pleura.

stent pain high up between the shoulders, as a rule, s with disease of the heart, aneurism of the aorta, of the bifurcation of the trachea and bronchi, or e of the esophagus. (Hilton.)

between the middle and the lower part of the scapulæ, ittle lower down, commonly known as a liver pain, is ive of disease of the abdominal digestive viscera; the eing carried to the surface through the medium of the planchnic and the intercostal nerves.

in the lumbar regions may be caused by morbid con- of the kidneys, bladder, and sexual organs.

al affections of the mid-dorsal region may manifest lves by a distressing pain, referred to the pit of the h. This symptom is of especial diagnostic value when s marked relief when the patient is in the recumbent e.

vere pain confined to the region of the abdominal mus- oes not necessarily indicate disease of the abdominal or structures, but may be caused by the pressure of fluid pleural cavities and by other lesions situated above the agm; the lower intercostal nerves which supply the inal muscles having to pass through these structures.

pes Zoster (Shingles).—This is an inflammation of the nerves (intercostal branches), manifested by an eruption follows the course of the nerve. This is usually uni- , but may be bilateral, encircling the trunk like a girdle. wer dorsal nerves are affected more frequently than the The affection is self-limited, running its course in a few The treatment is that of simple neuritis.

ercostal Neuralgia.—Intercostal neuralgia is met with frequently in females than in males. It may follow a, typhoid, pleurisy, exposure to cold and dampness; it e the result of injury, especially long-continued pressure

upon the nerve; it may occur in pregnancy and during la
tion; anæmic individuals are subject to it, and it may re
from reflex causes; it is also met with quite frequently
hysterical individuals.

The dorsal nerves may be the seat of a distressing and p
ful neuralgia, but, as a rule, it is of a mild form. The pai
confined to the course of the nerves. The pain is seldom
all at once in all its severity, but most commonly devel
itself progressively; at times it is tearing, at other ti
lancinating or jerking, and is always mingled with a burn
sensation. It is generally unilateral and confined to one in
costal space. When the pain is severe the patient leans tow
the affected side, and is afraid to take a long breath; a paroxy
may be excited by coughing, sneezing, or any other sud
movement in which the thorax and abdomen take part.
pain is usually felt on the left side, from the sixth to the ni
intercostal spaces.

The integument is often extremely sensitive along the cou
of the painful nerve, so that the slightest touch, even the pr
sure from the clothes, being unbearable. In a few cases, ho
ever, pressure over the painful region gives relief.

Intercostal neuralgia differs somewhat from other varie
in the fact that the patient often suffers from a dull, ste
pain along the nerve during the interval between the par
ysms; this pain is sometimes so severe as to compel him
restrain the movements of respiration on one side, as in ca
of pleurisy with effusion. There are certain tender poin
termed “puncta dolorosa,” observed in intercostal neural
Of these Putzel says: “They are usually three in number,
one or even two of these may be absent. They are term
respectively the *spinal* point, which is situated to one side
the spinous process at the exit of the nerve from the int
vertebral process; the *axillary*, situated near a line dropped fr
the middle of the axillary space, the *sternal* point, about
inch from the sternum.”

Mastodynia, or mammary neuralgia, is a form of intercos

ia. It may be caused by injuries, external pressure of
mmæ, tumors, etc. It occurs more frequently in
women and women suffering from menstrual derange-
It frequently follows herpes zoster. It affects the left
re frequently than the right. The pain radiates into the
nto the back, or down the hips. Lying on the affected
impossible. The treatment is the same as in inter-
ieuralgia.

reum.—Constricting and contracting pains transversely
he fore part of the chest; painful parts very sensitive to
e. Mezereum is the chief remedy in the treatment of
stal neuralgia, and is especially indicated if the neuralgia
after an attack of herpes zoster.

nicum.—Burning, tearing pains, especially at night, and
uring sleep, nearly driving the patient crazy; great
i; excessive weakness, has to lie down; pains come on in
sms; the affected parts feel cold; worse during rest after
ged exercise, at night in bed, or after rest and from
elieved by heat.

donna.—Lancinating, burning pains, aggravated by
, by contact; daily paroxysms from noon till night; a
ing, gnawing pain beneath the cartilages of the last rib;
welling and hardness of the mammæ; pains relieved by
up; worse when lying down and from a draft.

nia.—When every movement of the arm causes pain in
orresponding mammæ; also when complicated with
s.

atilla.—Tearing, lancinating, pulsating pains, worse
ying down at night, during rest; better in the open air.
ally useful when the neuralgia is associated with men-
derangements, or when there is a constant feeling of
ess.

s tox.—Numb sensation in the chest; stitches in the
iary region, or a painful lameness and numbness, relieved
tion or rubbing the parts.

The Lumbar Nerves.

The roots of the lumbar nerves are the largest of all spinal nerves. These roots pass downward and are of c siderable length, forming what is known as the (filum te nale) " cauda equina."

Like the other spinal nerves these nerves, immediately a their escape from the vertebral foramina, divide into anterior and posterior divisions. The posterior branches backward and supply the muscles and integument of the lo part of the back, and also a part of the integument of gluteal region. The anterior branches of the four upper l bar nerves unite and form the *lumbar plexus*. The ante branch of the fifth lumbar nerve unites with the sacral and h to form the *sacral plexus*.

Lumbar Plexus.

The lumbar plexus is situated in the substance of the ps muscle, in front of the transverse processes of the lum vertebræ. It is narrow above, where it is joined to the dorsal nerve, but below it becomes broad, and is connected w the sacral plexus by means of the lumbo-sacral cord. lumbar plexus gives off the following branches:

1. The *anterior crural nerve*, which is the largest branch the lumbar plexus. It arises from the third and fourth lum nerves, receiving also a fasciculus from the second. descends through the psoas muscle, emerging from it at lower part, at its outer border, then passes down between it a the iliacus, and passes beneath Poupart's ligament into thigh, where it divides into an anterior or *cutaneous* and a p terior or *muscular* part.

The anterior crural nerve supplies nearly all the musc which we employ in the first effort of progression; by means this nerve we flex the thigh, we extend the knee, and slightly evert the leg; and nearly all the muscles employed these various movements—the psoas, the iliacus, the pectine s, sub-crureus, the two vasti, the rectus, and sartorius es—are supplied by the anterior crural nerves. (John , " Rest and Pain.")

anterior crural nerve also supplies the joints which its es move, and the skin over the whole of the muscles of the as well as the skin on the inner side of the leg, as far as the inner side of the ankle-joint, and sometimes as far inner side of the dorsal aspect of the foot, thus following scia of the sartorius. Thus we see that not only are the named muscles supplied by this nerve, but also the *skin eir insertion, as well as the joints which they move.*

hin the pelvis the anterior crural nerve gives off a few branches to the iliacus and a branch to the femoral artery. nal to the pelvis it gives off: (*a*) The cutaneous nerves, and internal, the former being distributed to the anaspect of the thigh as far as the knee, the latter to the aspect of the thigh, leg, and foot as far forward as the toe; also one of the muscles of the thigh, the sartorius, es its nerve-supply from these nerves; (*b*) the muscular nes, which supply all the muscles on the front of the thigh neus, rectii, vastus externus and internus, and the s) except two, the *tensor vagina femoris,* which is supfrom the superior gluteal nerve, and the *sartorius,* which plied by the middle and internal cutaneous nerves; (*c*) the lar branches which supply the knee-joint; (*d*) the long nous nerve, which passes downward as far as the ankleand the side of the foot, being distributed mainly to the of the sartorius and the skin over it; thus carrying out the ple that *the same nerve which supplies the muscle supplies in over the insertion of the muscle;* the fascia of this on of the limb must, in fact, be considered as part of the ion of the sartorius.

The *obturator nerve,* which arises chiefly from the third fourth lumbar nerves, receiving some fibers from the d, emerging from between the third and fourth lumbar bræ, passing over the sacro-iliac articulation and downward

along the lateral wall of the pelvis, escaping through
obturator foramen and being distributed to the *obtur*
externus and the adductor muscles of the thigh (addu
brevis, adductor longus, adductor magnus, and the graci
As it passes the hip-joint it gives off a branch to the caps
ligament and another to the hip-joint to be inserted into
base of the ligamentum teres. This explains those sym
thetic pains associated with the hip-joint, which manifest th
selves at the knee-joint. A branch is also given off wh
supplies the interior of the knee, and another which supp
the inner side of that joint.

3. The *genito-crural nerve,* which arises chiefly from
second lumbar nerve, passes obliquely through the substa
of the psoas muscle, descending on the anterior surface of t
muscle down near to Poupart's ligament, and then divides i
two terminal branches—the genital branch and the cru
branch. The genital branch passes through the inter
abdominal ring and is distributed to the cremaster muscle
the male and to the round ligament in the female. The cru
branch passes beneath Poupart's ligament, pierces the fas
lata, and is distributed to the skin of the upper and anter
part of the thigh, anastomosing with the middle cutane
branch of the anterior crural nerve. These nerves are rarely t
seat of disease themselves, but only in connection with mor
conditions affecting some of the main branches of the lum
plexus.

4. The *external cutaneous nerve,* which arises from t
second and third lumbar nerve. It emerges from the ou
border of the psoas muscle about its middle and crosses t
iliacus muscle in order to reach a notch below the anter
superior spine of the ilium, where it passes under Poupart's lig
ment into the thigh, dividing into an anterior and a poster
branch. The anterior branch pierces the fascia about fo
inches below Poupart's ligament, and becomes superficial and
distributed to the integument along the anterior and out
part of the thigh as far down as the knee. The posteri

supplies the integument from the crest of the ilium as n as the middle of the thigh.

he *ilio-inguinal nerve,* which arises from the first lumbar pierces the psoas, passes obliquely across the quadratus um muscle, then passes through the transversalis , enters the inguinal canal, passes down through the l canal, escapes at the external abdominal ring, and is ted to the skin of the scrotum in the male, the labium emale, and the skin of the upper and inner portion of the

The *ilio-hypogastric nerve,* which arises from the first nerve, pierces the psoas, crosses the quadratus lum- to the crest of the ilium, perforates the transversalis , and divides into two branches: (*a*) An iliac branch, supplies the skin of the gluteal region; (*b*) an hypogastric , which is distributed to the skin of the hypogastrium the gluteal region midway between the anterior and or spinous processes of the ilium.

Diseases of the Lumbar Nerves.

ralgia of the Crural Nerve.—It is usual to classify all ic affections of the lower limbs under the general heading ica; this is incorrect, for in many cases the neuralgia is d exclusively to the crural nerve; both forms are, how- ften associated. The affection may begin in one set of and extend to the other in the course of the disease.

rural neuralgia the pain is felt in the distribution of the l and middle cutaneous nerves to the anterior and inner of the thigh, and sometimes the inner part of the leg ot as far forward as the great toe.

character of the pain presents no peculiarities apart from lescribed in other forms of neuralgia. There are certain points along the course of the nerve which are diagnos- this affection; according to Ranney, they are as follows: crural point at the exit of the nerve below Poupart's nt.

2. An anterior femoral point at the place of exit of saphenous nerve through the fascia lata.

3. An articular point at the inner side of the knee-joint.

4. A plantar point on the inner side of the foot.

5. A digital point over the tuberosity of the big toe.

In *paralysis* of the muscles supplied by the anterior cru nerves (the anterior thigh muscles) the leg cannot be flexed the hip-joint and the foot cannot be extended forward wh sitting.

Neuralgia of the *obturator* nerve may be caused by dise within the vertebral canal, a diseased vertebra, inflammati of the sacro-iliac articulation, psoas abscess, cancer of sigmoid flexure of the colon, and hip-joint disease. The pa is usually confined to the inner aspect of the knee.

In *paralysis* of the muscles supplied by this nerve the thig cannot be abducted, the knees cannot be brought togeth nor can the affected leg be crossed over the other.

The *ilio-hypogastric* and the *ilio-inguinal* nerves may be t seat of a distressing form of neuralgia. The pains are usua paroxysmal and of a lancinating type, radiating in the cou of the nerve. It is to be differentiated from various oth affections causing pains in the lumbar region (renal col uterine troubles, etc.) by the tender spots (puncta doloros These are located in the following regions:

1. A lumbar point, near the spinous processes of the lumb vertebræ.

2. An iliac point, near to the crest of the middle of the iliu

3. An inguinal point, in the inguinal region.

4. An hypogastric point, near the external abdominal rin

The treatment of these various affections of the lumb nerves corresponds, in the main, to the treatment of the vario morbid conditions of the sacral nerves, and is given under th heading.

The Sacral Nerves.

The roots of the sacral nerves, like those of the lumbar, a of great length (on account of the spinal cord not extendi

the first lumbar vertebra), and constitute what is known
" cauda equina."
nerve divides into a posterior and an anterior division.
sterior branches are distributed to the multifidus spinæ
integument over the postern part of the gluteal region
that over the coccyx. The anterior branches of the
upper sacral, and a small fasciculus from the fourth,
er with the lumbo-sacral cord (formed by the fifth lumbar
ranch from the fourth), forms the *sacral plexus*.
fourth anterior sacral nerve, after sending a small fila-
o help form the sacral plexus, also a small filament to the
ivides into two sets of branches—*muscular* and *visceral*.
uscular branches are distributed to the levator ani,
er ani, coccygeus, and a few cutaneous filaments to the
ment between the anus and the coccyx. The visceral
es are distributed to the viscera of the pelvis, the rectum,
r, and vagina. These branches communicate with the
thetic, helping to form the hypogastric plexus.
fifth sacral nerve is distributed to the coccygeus muscle
e integument over the back part and the side of the

coccygeal nerve divides into two divisions, the posterior
distributed to the fibrous structure on the back of the
; the anterior being distributed to the integument over
ck part and side of the coccyx.

Sacral Plexus.

sacral plexus is formed by the anterior divisions of the
upper sacral, part of the fourth, and the lumbo-sacral
ormed by the fifth lumbar and a branch from the fourth).
ese nerves converge to form a single, broad, flat cord,
lies on the anterior surface of the pyriformis within the
leaving the pelvis through the lower part of the great
sciatic foramen.
plexus supplies the extensors and rotators of the hip, the
of the knee, and all the muscles that move the foot,

together with the skin of the gluteal region, the back of thigh, the outer side and back of the lower legs, and most the foot. The branches given off by this plexus are:

1. The *muscular branches,* which supply the five muscles t are chiefly instrumental in rotating the thigh externally, pyriformis, obturator internus, gemellus superior, gemel inferior, and the quadratus femoris.

2. The *superior gluteal nerve,* which passes from the pel to the upper part of the great sacro-sciatic foramen a divides into a superior and an inferior branch. The super branch supplies the gluteus minimus and the gluteus medi the inferior branch is distributed chiefly to the tensor vagi femoris, but also gives off a few filaments to the gluteus medi and minimus.

The superior gluteal nerve is the one which presides chie over the act of internal rotation of the thigh, since these mu cles are the only ones which can perform this limited mov ment of the femur. (Ranney.)

3. The *pudic nerve,* which arises from the lower part of t plexus, escapes from the pelvis through the great sacro-sciat foramen, crosses the spine of the ischium, and re-enters t pelvis through the lesser sacro-sciatic foramen. The pud nerve gives off one branch, the inferior hemorrhoidal, which distributed to the sphincter muscles of the rectum and t skin around the region of the anus, its terminal filaments com municating with the inferior pudendal and superficial perine nerve at the fore part of the perineum. The pudic ner finally divides into two terminal branches, the perineal ner and the dorsal nerve of the penis.

The perineal nerve, the inferior and larger of the two termin branches of the pudic, again divides into two sets of termin filaments—the cutaneous or superficial perineal nerves an muscular branches. The cutaneous or superficial branches a distributed in the male chiefly to the integument of th perineum, the back part of the scrotum, and the under side the penis; and in the female to the external labia and perineum filaments are also distributed to the sphincter ani and the or ani. In the region of the anus these branches comcate with the branches of the inferior hemorrhoidal nerve. nuscular branches are distributed to the transverse perinei, erator urinæ, erector penis, and compressor urethræ es.

e dorsal nerve of the penis, the superior division of the nerve, is distributed to the integument of the dorsum ie penis and also the glans penis. It also gives a branch to the corpus cavernosum. In the female it is buted to the clitoris.

e pudic nerve is the nerve of motion to the muscles of the eum and urethra, and of sensation to the integument of the eum, scrotum, labium, penis, and the mucous covering e clitoris, as well as that lining the urethral canal

The *small sciatic nerve,* which rises from the lower part of acral plexus, passes out of the pelvis through the great -sciatic foramen, and is distributed to the integument of erineum and back part of the thigh and leg, and to one le, the gluteus maximus. Its branches are: (*a*) The or gluteal (muscular), which supplies the gluteus max- and, according to Hilton, sends a few filaments to the of the penis; (*b*) the inferior pudendal, which is distributed e integument of the upper and inner part of the thigh, and ie scrotum or labium, communicating freely with the ficial perineal and inferior hemorrhoidal nerves; (*c*) the ieous, which are distributed to the skin over the gluteus mus, the inner and outer aspect of the thigh, and a few hes passing downward supplying the skin of the back part e thigh, popliteal region, and the upper part of the leg. lesser sciatic is rarely affected independently with disease.

The *great sciatic nerve,* which is the largest nervous cord e body, supplies nearly the whole of the integument of the he muscles of the back of the thigh, and those of the leg oot. It arises from the lumbo-sacral cord and the four sacral nerves, and is a direct continuation of the sacral plexus. It passes out of the pelvis through the great sa sciatic foramen, passing between the trochanter major and tuberosity of the ischium, descends along the back part of thigh, giving off branches to the ham-string muscles the adductor magnus, and some articular branches to the b of the hip-joint; about the lower third of the thigh it divi into two terminal branches, the internal and external popli nerves.

The internal popliteal nerve, which is the larger of the terminal branches (being, in fact, a direct continuation of sciatic) descends along the back part of the thigh, through middle of the popliteal space, giving off: (*a*) Articular branc which are distributed to the knee-joint; (*b*) muscular, wh supply four muscles in the immediate vicinity of the knee— gastrocnemius, plantaris, soleus, and popliteus; (*c*) the exter saphenous, which supplies the integument of the outer side the foot and little toe; and at the lower border of the poplit muscle taking the name of the *posterior tibial* nerve. T posterior tibial descends along the back part of the leg, givi off muscular branches to the tibialis posticus, flexor long digitorum, and flexor longus pollicis; also a cutaneous bran which supplies the integument of the heel and inner side of t sole of the foot, and an articular branch to the ankle-joi then finally divides into two terminal branches, the inter and external plantar nerves, which are distributed to t integument and muscles of the foot, being, in fact, the ch nerve-supply of the structure of the foot.

The external popliteal (peroneal nerve) passes through t outer part of the popliteal space, giving off articular branch to the outer and anterior aspect of the knee, and about an in below the head of the fibula divides into two branches, t anterior tibial and musculo-cutaneous nerves.

The anterior tibial passing down the leg, gives off muscul branches to the tibialis anticus, extensor longus digatoru peroneus tertius, and extensor proprius pollicis, and an artic lar branch to the ankle-joint; then divides into an external a al branch, which are distributed to the articulation of rsus and metatarsus, and to the outer side of the big d the inner side of the second toe.

musculo-cutaneous nerve, passing down the leg, gives iscular branches to the muscles on the fibular side of the e peroneus longus and brevis, and cutaneous branches to tegument of the lower part of the leg, then divides wo terminal branches—internal and external. These ies together supply the integument of the inner and sides of the ankle, of the inner and outer sides of the ind of all the toes, excepting the outer side of the little upplied by the external saphenous) and the adjoining of the great and second toes (supplied by the internal i of the anterior tibial).

iseases of the Sacral Plexus and its Branches.

alysis of the muscles supplied exclusively by the *superior* l nerve is rare, but these muscles may become affected result of a lesion which involves the sacral plexus to a r or less extent.

perience has proven that the *pudic nerve*, from its five pal terminal branches—namely: (1) Those supplying the er; (2) the rectum; (3) the penis or clitoris; (4) the labia erineum; (5) the uterus and appendages—is the bearer of messages of discord to the two brains of the body ly, the sympathetic and cerebro-spinal) than all the other s combined, and that irritation of one or more of its hes is responsible for the major part of the reflexes ntered in chronic diseases.

sms of the muscles supplied by the *great sciatic nerve* follow diseases of central origin (lesions of the brain) or es of the spine, hip-joint, knee-joint, psoas abscess, ria, chorea, and tetanus. These spasms may be of a tonic nic variety. In the tonic variety the contracture may great as to eventually cause the loss of the use of the

Rapid and painful tonic spasms of the calf of the leg an the sole of the foot may be caused by exertion in certain o pations, as in dancers who dance upon tip-toe, in men c pelled to make forced marches, or by chilling of the feet, o reflex action, as in cholera. (Rosenthal.)

Spasms commencing in the soles of the feet may exten the dorsal surface of the foot and to the calf of the leg.

Paralysis of the sciatic nerve may be caused by injurie the nerve-trunk, in the nature of a laceration or section of nerve; by dislocation of the hip, tumors in the course of nerve, neuritis, especially multiple neuritis, and spinal disea

A lesion of the sciatic nerve near the sciatic notch paral the flexors of the leg (which are also extensors of the hip) all the muscles below the knee; also there is anæsthesia of outer half of the leg, the greater part of the dorsum of the f and all the sole, the inner and outer parts of the leg escap the anæsthesia on account of being supplied by the ante crural.

In addition to the loss of power of the lower limbs, there be trophic disturbances, as mottled spots, ulceration of skin, eruptions, bed-sores on the heels, ankles, and over sacrum, and finally atrophy or wasting of the muscles.

Sciatica.

(*Neuralgia of the Sciatic Nerve, Sciatic Neuritis.*)

All affections come under this heading in which the pai confined to the sciatic nerve and its distribution. Th are two types of sciatica—inflammatory (sciatic neuritis) non-inflammatory (sciatic neuralgia). The first type, scia neuritis, is an inflammation of the sheath of the sciatic ner and may be caused by exposure to cold, standing in wat sitting on the damp ground, extension of inflammation fr other structures, as diseases of the sacrum, periostitis of ilium, but more especially hip-joint disease. The second ty sciatic neuralgia, may be caused by tumors in the pelvis along the course of the nerves of the thigh and leg, aneuris rged or varicose veins pressing on the sciatic nerve, mulation of fæces, or a depressed state of the nervous em. Sciatica may also be due to spinal affection, hysteria, metallic poisoning. Predisposing causes to either affec- are gout, rheumatism, syphilis, gonorrhea, malaria, oid fever, and puerperal fever. Age is a predisposing e. It is met with chiefly in the adult period of life, rarely ie young, and is more frequent in males than in females. is usual to class both of these types under the heading of algia, but this is erroneous, for, as Gowers has pointed out, e vast majority of cases it is essentially a perineuritis.

mptoms.—The chief symptom is a pain along the sciatic e and its branches, mainly in those distributed to the skin.* pain, beginning in the lower lumbar region, extends to uttock, thigh, popliteal region, and the adjacent part of calf of the leg, sometimes extending to the external eolus, the heel, and the outer surface of the foot.

ie affection may begin suddenly, especially in cases of matic origin; in that case there may be slight fever and sponding constitutional symptoms, but more frequently it is as a dull, heavy ache, which gradually becomes more and intense. The pain is usually markedly increased by motion e muscles, and the paroxysms seem to be excited by the trivial causes, such as a draught of cold air, coughing, ing, sudden bending of the body, by the contact of the es with the skin, or straining during the acts of defecation icturition. If the whole area of the distribution of the sci- ierve be involved, the pain occurs with special violence, first e, then in another branch, while the posterior branches of acral nerves may also be implicated, and the patient com- s of violent pain in the sacrum and the loins. The pain be more or less constant, somewhat remittent, but never

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e pain and tenderness in the nerve is due to irritation of the nervi nervorum, ves that supply the sheath. The pain referred to the distal portion of the s due to the irritation of the nerve-fibers by the interstitial inflammation, and to emphasize the well-known law that an irritation of a nerve-fiber manifests the peripheral distribution of that nerve.

entirely intermittent; or, again, the pain may be so continu and severe that sleep is almost impossible. It may be dul acute, and is usually worse at night; any movement which a tendency to put the nerve on the stretch aggravates pain.

Pressure on localized points always develops pain. principal painful spots are: (1) Just above the hip-joint; at the sciatic notch; (3) about the middle of the thigh; (4 the popliteal space; (5) at the head of the fibulæ; (6) bel the external malleolus.

The pain is usually most intense along the back of the th following the course of the sciatic nerve. Anæsthesia generally present, and is generally confined to the outer of the leg, the greater part of the dorsum of the foot, and the sole. There may be muscular contractions. There be atrophy of the muscles, indicating a lesion of the ne fibers. There may be a diminution in the temperature of affected limb, the limb being cold; also diminution of perspiration.

Prognosis.—The prognosis depends upon the ability remove the cause. In the idiopathic, rheumatic, and traum types, those types which follow the puerperal condition, typh fever, or syphilis, and also those types in which an exist compression of the nerve may be removed, the prognosi favorable. Those types due to hip-joint disease, aneuri varicose veins, and tumors within the pelvis are unfavora as regards a speedy cure.

A mild case may run its course in a few weeks; other ca may continue for months, or even a year. When the ne is so sensitive that the patient cannot stand, the affection continue for months. Recent cases in young and previou healthy individuals terminate more rapidly than those occ ring in older persons. A person who has had one attack sciatica is more liable to another.

Diagnosis.—The distinction between a sciatic neuritis an sciatic neuralgia is sometimes difficult. In sciatic neuritis s confined more to the track of the nerve and is aggra- by the least movement; while in sciatic neuralgia the s referred more to the branches and distribution of the or darts up and down the trunk, and movement affects e, if at all.

ciatic neuritis there may be paresis, or even paralysis and ht wasting of the limb; while in sciatic neuralgia these oms are absent. Finally, if we recognize that all cases atica with persistent tenderness of the nerve are really is, cases of sciatic neuralgia become extremely rare.

eatment.—In the early stages rest is an important factor. ostures and all movements which have a tendency to se the pain should be avoided. Hot poultices of linseed .applied along the course of the nerve, will often give relief and help cut short the inflammatory stage. oping the limb in hot cotton batting will often give orary relief.

the electrical treatment the best results are obtained from se of the galvanic current. One electrode, a large, flat s placed over the sacrum or lower lumbar vertebræ, while ther is placed over the tender points along the course of erve. The position of the poles will vary according as hether it is a sciatic neuritis or sciatic neuralgia. In c neuritis the positive pole should be placed over the lum- egion, the negative over the track of the inflamed nerve; in sciatic neuralgia the best results are obtained by ng the negative pole at some indifferent part of the body, ositive over the painful points. The application is made or every alternate day, the *seance* lasting from five to ten tes.

e faradic current (secondary current) will prove beneficial any cases; one pole applied to a point of the skin where runk of the nerve is accessible, the other pole applied to terminal branches of the nerve, and the action of the ent kept up for fifteen or twenty minutes. The pain mes much less after a time, and a feeling of numbness is felt in the limb. In some cases the faradic wire **brush,** app to the dry skin, has been known to permanently **relieve** pain.

Very good results are often obtained from the use electric baths. The ascending direction of the current sh be preferred; that is, the positive pole to the feet, or placed the gluteal region, and the negative between the should Usually ten to twelve baths should be given.

Nerve-Stretching.—In very obstinate cases, nerve stre ing may relieve the severe excruciating pains and check progress of the disease. It acts in three ways: (1) It rele the nerve from compressing adhesion (caused by tumors); it acts as an energetic counter-irritant; (3) it enforces rest.

The operation is not a very painful one, the only pain be that caused by the incision through the skin, and this be abolished by rendering the skin anæsthetic by an ether sp To perform the operation, make an incision four or five inc in length at the junction of the middle and lower third of thigh, that being the point at which the nerve is most rea reached. After exposing the nerve, it should be lifted up the finger or some blunt instrument, as the handle of scalpel or a blunt hook, care being taken not to injure nerve-tissue. The nerve may then be stretched to the ext of three or four inches. Always make the traction in a *do ward* direction. There may be numbness, or even a sli paresis for a few days following the operation, but this gradually pass away.

Colocynth.—Violent, continuous, tearing, sticking, burn pains from the sacrum along the course of the sciatic ner severe sticking, tearing pains from the hip to the knee, m ing him cry out; can neither lie, sit, nor walk; can find no co fortable position; pains worse from warmth of bed; fr motion; crampy pains as though the parts were screwed i vise; lies on the affected side with the knee drawn up; p extending down the sciatic nerve to the knee or even to heel; attacks of pain followed by numbness of the whole li

artial paralysis; twitchings of the muscles; sensation of
ation in the affected part; pains usually worse at night.
ynth is more especially useful in recent cases and where
ins come on suddenly and are constant.

s tox.—Tearing and drawing pains from the hip to the
while walking or standing; violent tearing or burning
eginning at the tuberosity of the ischium, following the
of the sciatic nerve, spreading over the thigh, knee, and
orse at night, increasing in intensity until it drives the
t out of bed and obliges him to walk about for relief;
g or burning, tearing pains, increasing during rest, and
ted only for a short time by motion; heaviness, lameness,
ven actual paralysis of the affected limb; frequent
ysms of cramps in the calves; burning and tearing pains
led by numbness and formication; sensation of cold, and
tic stiffness of the affected limb; pains worse during rest,
ally rest in bed; better from dry heat. Rhus is especially
in the advanced stages of sciatica, and where the affection
ght on by exposure to wet and dampness.

enicum.—Pain back of the great trochanter, extending
the thigh along the course of the sciatic nerve, spreading
ward the knee, embracing the patella, then passing down
ia to the ankle; pain relieved somewhat by the flexion
knee; burning, tearing pains, with great restlessness,
ng the patient to move the limb often in order to obtain
cannot lie on the painful side; marked periodicity in the
ence or aggravation of the pains; tearing and burning
with nightly aggravations; worse about midnight; some-
relieved by warm applications and by rubbing the affected
aggravated by touch, by motion, by cold applications.
atient is extremely restless, unable to remain long in the
position, is pale, emaciated, and is subject to dyspnœa
nting spells from the slightest exertion.

opodium.—Burning and stinging pains, with complete
ission; pains drawing, tearing, worse at night; stiffness
weakness of the affected limb; muscles and joints

rigid; numb sensation in the affected parts; affected parts
cold; painful muscular twitching; frequent jerking of the l
while either awake or asleep; limbs go to sleep easily; pro
fetid foot sweat; burning of the soles; feet sore and swo
Lycopodium is more especially useful in chronic cases.

√ *Belladonna.*—Severe, lancinating, burning pains comin
in the afternoon or evening, or else worse from noon till
night, aggravated by the lightest touch, but frequently reli
by steady pressure; pains especially severe at night, so tha
has to change position often; wants to sleep but cannot sl
pains aggravated by motion, noise, shock, contact; ca
bear the clothing to touch him; also aggravated by the l
draught of air; better from letting the limb hang down, f
warmth, and when in an erect posture.

√ *Bryonia.*—Shooting pains extending toward the th
stitches in the hip-joint, extending to the knee; pains o
aching, cramp-like, and bruised kind; twitching pains exten
from the lumbar region to the thigh; pains attended
shock in the affected limb; pains aggravated by sitting up
motion, and late in the evening; lies best on the painful
pains often relieved by hard pressure and by applicatio
cold water.

Mercurius.—Lancinating pains in the hip-joint and in
knee, particularly at night and during motion; drawing
heaviness in the affected limb; sensation of coldness in
affected part; numbness and formication of the limb; chilli
and dread of cold air; night sweats; great tendency to sw
without any relief.

Cocculus.—Pain as if the hip was screwed together,
shooting pains, like lightning, down the whole limb; the l
jar or motion is painful; after the paroxysm the parts feel nu
as if asleep; drawing pains down the thigh and calves; he
plegia with numbness; great lassitude and weakness of
whole body; great emaciation.

Ferrum phos.—The pain is at first increased by motion,
improves by continuance of motion; more particularly suit

orn out individuals with extremely irritable nervous ns.

phalium.—Gnaphalium is very similar to colocynth in a. It has intense neuralgic pains along the course of the nerve, alternating with numbness.

nite.—Numbness; a pricking sensation; sense of coldness parts, or the opposite, a sensation of increase of tempera- vith heaviness, aching, and a drawing, tearing pain in the unbearable pains, especially at night; patient is restless, ess, groaning; there is great thirst, great anguish, great pulse full and slow, or sometimes an accelerated, small, ly pulse. Aconite is especially useful in sciatica caused posure to cold and dampness or by the suppression of the ration.

i hydriod.—When the pains are worse at night and from on the affected side, and when the trouble is of mercurial philitic origin.

fea.—Pains unbearable, cries and throws himself about; ks irregular in appearance and lasting several hours; y at night or in the afternoon. Neuralgia of the crural worse by walking, better by pressure; pains in ysms; tearing, stitching; worse afternoons and nights; restlessness and sleeplessness. Coffea is especially useful ose cases of sciatica where there is great mental and cal exhaustion, lassitude, and general debility.

zereum.—Darting pain in hip-joint down to knee; drawing along the whole thigh, leaving a painful weakness, hinder- valking; feels as if his flesh were torn from the bones; tion of internal heat, surface being cold; worse from touch, on, and in the evening; better in the open air.

x vom.—Lightning-like pains, with twitching of the ted parts; darting pains from the toes to the hip or from rochanter to the hollow of the knee; violent agonizing , obliging the patient to change his position frequently; pain along the affected limb down into the foot; paralytic ing in the muscles of the thigh and calf, painful on walking; limb stiff and contracted; parts feel paralyzed and co worse early in the morning; better by lying on the affec side; from hot water. Especially useful in cases where bowels are constipated, and in those addicted to the use alcoholic stimulants, or those of sedentary habits.

Plumbum.—Drawing, pressing pain in the posterior part the thigh, along the course of the sciatic nerve, extending the knee; walking is difficult and exhausting; lightning-l pains coming in paroxysms, and associated with the pains severe cramps of the muscles of the legs. Sciatica where th is marked consecutive muscular atrophy.

Ammonium mur.—Tearing and painful jerks, now here, a again there; tearing, rheumatic pains in the extremities; f feel as if "asleep"; violent tearing and stitches, with ulcerat pains in the heels; at times relieved by rubbing; pains a worse while the patient is sitting, somewhat relieved wh walking, and entirely relieved when he lies down.

Ruta grav.—Shooting pains from the back down the scia nerve on first moving or on rising after sitting; ham-stri feels shortened; sore and weak; knees give way going up down stairs; pain deep seated as if in the marrow of the bo as if the bone were broken; obliged to walk about constan during the paroxysms of pain; pain worse sitting or lying dow constantly complaining about his suffering; burning, corrosi pains, worse in damp or cold weather, or from cold applicatio

For the treatment of paralysis of the muscles supplied this group of nerves, see chapter on "Paralysis."

Coccygodynia.

This is a form of neuralgia affecting the lower posteri branches of the sacral nerves. It is characterized by an acu pain in the region of the coccyx, especially when sitting standing, the pain usually radiating into the perineum towa the bladder, or even into the hips.

Ætiology.—It may be due to fracture with dislocation of t coccyx, caries of the last coccygeal vertebra, inflammation ccyx and its ligaments, inflammation of the coccygeal rheumatism of the fibrous tissues over the sacrum, or falls upon the coccyx; or it may follow difficult labors. stipation may act as a cause; the accumulation of fæces rectum pressing on the coccyx forcing it backward, thus g the tendons of the ligaments attached to this bone on etch, and if continued it causes them to become hyper-ic or neuralgic.*

teria is a more frequent cause of this affection than is lly supposed. Goodell says that the coccygeal joint is le to become hysterical as is the knee-joint or the other ations, and that, just as an hysterical joint will mimic tokens of some local injury, so will the hysterical odynia.

nptoms.—The chief symptom is a pain in the region of ccyx, aggravated by pressure or by movement. The pain e localized in the coccyx, or it may radiate toward the r, rectum, ovaries, and uterus, or downward into the The pain varies in different cases. In some it is of a lancinating, burning character, almost unbearable; while ners it is of a dull, agonizing nature, continuing for at times, however, more severe than at others. Some ts experience extreme difficulty in walking and in going ol. Others are unable to sit, on account of the discom-aused by pressure on the bone; or they are obliged to sit se upon the edge of a chair, or with the weight partially rted by a hand underneath the buttocks. In some cases npossible for them to rest in the sitting posture at all.

e coccygodynial pain is aggravated by coughing, by ing, by pressure upon the coccyx, by sitting, by rising, on ng the fæces, or by making any effort whatever which the coccygeal ligaments on the stretch.

st as uterine and ovarian pains may be reflected through ympathetic system of nerves to remote parts of the body, ay the irritation of the coccyx, whether it be organic or neurotic. The pain may alternate with a headache in occiput or in the vertex. It may be of the nature of an inte aching of the occiput and in the back of the neck; or agai some cases the distress in the head may not be in the natur an active pain, but takes the nature of an indescribable fee or sensation in the back of the head and neck; accompany this there may be mental symptoms, such as a confused feeli everything appears strange to her, even her most intim friends, familiar streets, and her own house; there is a se of fear and dread of the present and of the future. Th cases, if severe and long-continued, may eventually develop i insanity, especially melancholia. In other cases the coccyg pain may alternate with a pain in the left side under mammæ. When this pain is present, the coccygeal pai better, and, *vice versa,* the same is true of the occipital pa

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* Hale, "Diseases of the Coccyx and Coccygodynia."

Prognosis.—The duration of the disease is uncertain. may continue for years, unless the cause can be ascertai and removed. If the coccygodynial pain is merely a lo expression of the general neurosis, treatment directed in t line will cure the case. As long as the pains remain in coccyx with no relief from treatment, removal will cure, if up pressure the pain remains confined to the coccyx; but if pain radiates above the coccyx to the sacrum, excision will no good, for the pains will return after a longer or shor time.

Treatment.—The treatment will be: First, therapeutica remedies directed toward the neurotic element; second, el trical; and third, if the first two measures fail, surgical, wh will consist of (*a*) tenotomy, or, (*b*) removal of a part or of whole of the coccyx.

Belladonna.—Intense, crampy pains in the small of the ba and in the region of the coccyx; the parts sensitive, cannot b the least jar; pains come on suddenly and cease suddenly; s can sit only for a short time, for it makes her stiff, and una to rise again from pain; cannot lie down well, wakes often night, and has to shift position; feels best when standing

g slowly. Belladonna is the great remedy in all inflamma-
nd neuralgias of the organs and tissues of the pelvis, and
great majority of the cases of coccygodynia are due to
irritation of the pelvic organs, it is the remedy *par*
ıce.

sticum.—Causticum is one of the chief remedies in dis-
f the tendinous tissues and in neuralgias. It is indicated
there is a dull drawing pain in the region of the coccyx;
ıs from bruises; or darting pains in the coccyx; every
ıent in the body gives a pain in the small of the back;
ıg, crampy pain in the lumbar region and buttocks; pain-
ness of the back and sacrum, especially when rising from
.

ja.—Painful drawing in the sacrum and coccyx and in
igh when sitting; a burning in the coccyx; pain as if
in the small of the back, extending to the tip of the
; after having been seated a while, the drawing hinders
ıg erect; sudden, cramp-like pain in the lumbar region
ong standing, and when attempting to walk it seems as
ould fall. Thuja has the occipital headache like that in
eal reflex headache.

s tox.—Stiffness and lameness in the sacrum, worse on
after exercise; pain in the small of the back, worse when
still or when lying; better from lying on something hard
n exercise; drawing, jerking stitches as with a needle in
ccyx; heaviness of the lower extremities; lower extremi-
el bruised, they are so weary. Rhus is especially useful
there is a rheumatic tendency and especially where the
on is brought on from exposure to cold and dampness
n sitting on the damp ground.

grav.—This remedy has a sphere similar to rhus. Pain
n a blow or fall, extending from the coccyx to the sac-
ruised pain in the region of the coccyx; great weakness
short walk; limbs feel bruised: small of back and
re painful; on rising after sitting, she cannot walk; she
ıck again.

Actea rac.—Severe pain in the back, down the thighs, through the hips, with heavy pressing down; weight and p in the lumbar and sacral region, sometimes extending all aro the body; bearing down in the uterine region and small of back; sensation like electric shocks here and there; sharp la nating pains in various parts, associated with ovarian uterine irritation; rheumatic pains in the muscles of the n and back; feeling of stiffness and contraction; limbs feel he and torpid; dull pains in the occiput, with shooting pains d the back of the neck; top of the head feels as if it would off; worse going up stairs; declares that she will go cr Actea is one of the chief remedies in this affection. It not o has a special affinity for the tendinous tissues involved in affection, but also (as thuja) has the occipital headache like t in coccygeal reflex headache.

Magnesia.—Sudden piercing pain in the coccyx; sud violent, concussive, tearing, sticking pains in this region, if the spine were bent.

Lachesis.—Neuralgia of the coccyx, worse when rising must sit perfectly still; pain in the coccygeal bone when sitt down; feeling as if sitting on something sharp; continual p in the region of the sacrum and coccyx; drawing pain, a sprained, in the small of the back, preventing motion; *worse after sleep.*

Platina.—Pains in the back and small of the back, as if back were broken; pains worse from pressure or bending ba ward; pains in the small of the back, going to the groins down the limbs; numbness in the sacrum and coccyx; sensat of numbness in the coccyx as after a blow, while sitti tensive, numb feeling close to the occiput, as if tightly bou cramps in the posterior muscles of the neck; sensation of num ness in the head and externally on the vertex, preceded b sensation of contraction of the brain and scalp; worse in evening and while sitting; better from motion and when in open air.

Electrical Treatment.—Beneficial results have been from all three forms of electricity. When the galvanic is used one pole (the positive) should be placed over the the pain in the coccyx, and the other pole (the negative) placed in the rectum by means of a rectal electrode or to some indifferent portion of the body by means of flat electrode. In those cases where the history points eumatic condition of the ligaments and tendons of the faradization will be the form of current to choose. electricity will give good results in many cases. Insulate ient with the negative pole and apply the positive sparks to the seat of pain.

ical Treatment.—When the affection is due to dislocation the coccyx, reduction may be easily accomplished. In f long standing, however, it is almost, if not quite, im- e to reduce it. Dislocation is recognized by feeling the the coccyx, by passing the finger into the rectum, and internally the point of the sacrum. The two parts ought to be in contact are separated from one another e dislocation is backward.

ases where all other measures have failed, then one of rgical measures will be called for: (1) tenotomy; (2) l of the coccyx. In tenotomy the coccygeal bones, as should be completely isolated from the surrounding lar and tendinous fibers by means of a tenotomy knife. case, however, will not call for a complete division of tendinous structures; a partial division will often suffice. omy will often give instant and permanent relief from the In removal of the coccyx the bone as a whole may be culated from the sacrum, or the last two segments only removed. As a rule, the removal of the last two bones cient.

mas gives the following method of procedure for per- g tenotomy and for removal of the coccyx: "The first ion [tenotomy] may be performed subcutaneously by an ry tenotomy knife. This is passed under the skin at the point of the coccyx, turned flat, and carried up between

the skin and cellular tissue until its point reaches the sa
coccygeal junction. Then it is turned so that in withdraw
it an incision be made which entirely frees the coccyx f
the muscular attachments. The knife is then introduced on
other side so as to repeat the section there. As is usually
case in subcutaneous operations, no hemorrhage occurs, un
some large vessel be injured. I have resorted to this pro
ure but once, when I found it exceedingly difficult of acc
plishment, and it proved an entire failure in giving relief.
fat women subcutaneous section of the muscles attached to
coccyx is by no means so easy a matter as one would supp
who has not made the experiment. Under these circumstan
the operation is simplified and rendered more certain by m
ing an incision down upon the coccyx, lifting the expo
extremity of this bone with the finger, and then with a
of scissors severing the muscles. The procedure is both e
of performance and certain as to result—that is, supposing
is resorted to in a case really demanding it. Should deta
ment of the muscles fail, as it will do if the bone be diseas
an incision should be made over the coccyx, the bone laid b
by severance of its attachments, and the whole of it remo
by a pair of bone forceps, or disarticulated by the knife,
practiced by Dr. Nott. By one of these procedures cure
be confidently promised, and as neither is attended by dang
our resources in this affection may be regarded with gr
satisfaction."

There are a few cases, however, where tenotomy has gi
only temporary relief, and others where even complete remo
of the coccyx has been followed by no relief whatsoever.

DISEASES OF THE PERIPHERAL NERVOUS SYSTE

Neuritis.

(*Inflammation of a Nerve.*)

Neuritis is quite a common affection, and is too frequen
mistaken for neuralgia, rheumatism, and at times for locom
tor ataxia or other diseases of the spinal cord.

ritis may be either acute or chronic. The acute stage, checked, soon subsides into the chronic. The inflam- ı may begin in the outer sheath of the nerve or the fibers, and eventually involve all the structures, finally ying the axis-cylinder, causing nerve degeneration.

en it is confined to the sheath, unless the nerve lies in a canal, within which the sheath cannot expand, there is ttle destruction of the nerve-fiber; but if the inflamma- in the nerve-fibers, it may cause compression and result eneration. Some of the nerve-fibers, however, suffer than others. If the process is outside of the nerve- ts, it is termed interstitial or adventitial; if inside, it is l parenchymatous.

inflammation may begin in the periphery of the nerve cend upward—"ascending neuritis." When the neuritis s the nerve, the symptoms gradually extend in area, and aches the plexus from which the nerve proceeds, it may l to most or all the nerves of the limb.

ology.—Injuries by wounds and by overextension of the . Quite a common cause is from fractures and disloca- Sleeping on the arm may cause a neuritis of the al plexis. It may be caused by an extension of the nation from the surrounding structures. It also de- in the course of certain diseases—for instance, after specific fever, such as diphtheria, measles, malaria, d, etc. Syphilis acts as a predisposing cause. It may result of toxic causes, as from alcohol, or more especially ead and arsenic poisoning. One of the most common , however, is exposure to cold and dampness.

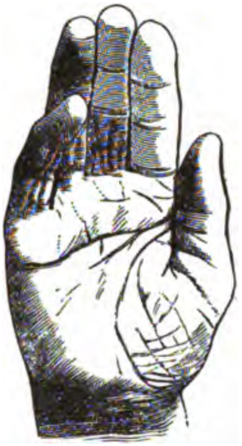
nptoms.—Acute and chronic cases present about the symptoms, with the exception that in the chronic the tutional symptoms are absent and it runs a longer course. ymptoms of neuritis vary according to the nerve affected ccording to its extent and intensity. Pain is the most nent symptom. The pain is not of a sharp, lancinating, g, intermitting type, as in neuralgia, but is of an intense, burning character; usually worse at night and increased motion. This pain may be located in the nerve-trunk c or may be felt in the parts which it supplies. Sometimes pain is felt in the corresponding region of the opposite limb. the nerve is superficial, you may be able to trace the cours the nerve-trunk by its appearance, being red and swollen.

In cases of inflammation of the motor nerves, spasms and alysis are the chief symptoms, the later being perma should the function of the nerve not be restored. The sp or contraction is due to a well-known law that *irritat applied to a nerve-center or a nerve-trunk are more ac felt at the points of distribution of the nerve than at the of irritation;* hence the clonic contractions which are pre in the early period of the affection. In the motor nerves pain may be absent. This is due, as Gowers points out, to fact that its sheath contains fewer sensory fibers than the sensory nerves.

If the neuritis is of long standing, there may be tro changes in the skin supplied by the affected nerve. The may become thickened, having a glossy appearance; it become atrophied. Herpetic eruptions may develop along course of the inflamed nerve; especially is this true when special nerves are affected. The parts of the skin supp by the inflamed nerve may be subject to an increase perspiration.

Pathology.—In acute inflammation the affected part of nerve is red and swollen and tender to the touch. The and tenderness of the nerve-trunk are due to the increa sensitiveness of the "nervi nervorum" distributed in the shea The sheath of each nerve is supplied with nerve-fibers from main trunk of the nerve, and these fibers may be very rea deranged. The inflammation may continue along a consid able tract of the nerve, but more frequently it is located spots or at certain localities, as over bony prominences, where the nerve turns around the bone, or where it emer from the bony canal, with intervening portions of heal

e. The connective tissue is increased in amount and an lation of fibrine is thrown out. If resolution results, these ucts are absorbed and the nerve regains its normal con-



. 49.—Showing the Trophic Change of the Skin, the Result of Neuritis.

n; but if it should pass into suppuration, then the nerve become disorganized through granular degeneration.

iagnosis.—Neuritis is distinguished from neuralgia by the ry of the case and by the fact that the pain does not inter- that there is more pain and tenderness, that the pain and erness is limited to the distribution of a single nerve, and the tender spots are more localized.

euritis is distinguished from cerebral or spinal diseases by absence of central symptoms and by the restricted limits ne morbid phenomena. The chief diagnostic feature of itis, however, is the occurrence of pain associated with lysis, wasting, and impaired sensation.

rognosis.—The prognosis depends upon the intensity of symptoms and the evidence of degeneration. As a rule, ever, it is favorable unless the nerve is affected secondarily local suppurative inflammation, and in that case it may e " chronic neuralgia " or local paralysis and contractures.

A slight attack may run its course from within a few days t many weeks. If complete degeneration ensues, it will req months before the nerve is fully restored to its normal f tion, if ever. Regeneration does not occur until the orig cause has been removed. In old people the pain is apt to longer than in the young and middle-aged.

Treatment.—See treatment at the end of "Mult Neuritis."

Multiple Neuritis.

(*Polyneuritis.*)

This is an inflammatory, degenerative affection, an affect in which many nerves are inflamed simultaneously in rapid s cession, and characterized by wasting of the muscles with sc motor weakness. The neuritis is not only multiple, but is a symmetrical, affecting homologous nerves. Thus the co sponding nerves on the two sides are almost always affect

Multiple neuritis begins and is the most intense at peripheral distribution. The peripheral distribution of affection is probably due to the fact that the vitality a nutritional energy of the nerve-fibers lessen with the dista from the cells of which they are a part and from which th derive their vitality. The vitality of a nerve-fiber and power of resisting morbid influences are less the greater distance from the cell from which it springs and of which it really a part.

Ætiology.—Multiple neuritis is due to a morbid blood-sta having a direct influence on the nerve-tissue. This mor condition of the blood is caused by some virus to which t nerve-fibers are susceptible. This explains the symmetry of t affection. This is why homologous nerves on both sides a affected, since like structures on each side possess the sa characteristics, and, being exposed to this morbid blood-sta suffer in equal proportion.

The principal causes are alcohol, lead, arsenic, and silv Diphtheria, small-pox, typhoid, and some other low forms produces a virus (probably the ptomaines of the organ- which causes a profound morbid condition of the blood. er class of causes is due to exposure to cold or over- on, bringing on a rheumatic neuritis. Another cause -beri, an affection prevalent in Japan, due to an organism products setting up a multiple neuritis. Kak-ke is an inese name for the same affection.

re are other cases the cause of which is not always under- an instance of this is the type of multiple neuritis met t the time of the climacteric in women where they are ted to pain, formication, and numbness and weakness ing on paresis. It attacks both sexes, and is most com- etween the ages of forty and fifty.

ptoms.—The symptoms of multiple neuritis vary ing as to which of the four following sets of fibers sustain eatest amount of damage: 1. Motor, in which there is loss er with or without the other symptoms. 2. Sensory, in the sensory disturbance is the chief symptom; in this here may be no marked weakness or inco-ordination. 3. ic, in which form œdema, excessive perspiration, and a skin may be the chief symptoms. 4. Inco-ordination or , in which the inco-ordination is the chief symptom; in this here may be very little loss of power and but few sensory oms.

he main nerve-trunks the motor, sensory, co-ordinating, rophic fibers are so intermingled that a lesion of the nerve could hardly fail to involve each.

onset of multiple neuritis may be acute or subacute. atient may have a chill or an attack of vomiting, followed elevation of temperature, the temperature running up to r 104°. In other cases the first symptoms may be obscure, ting of a tingling and numbness or burning sensation fingers and toes. This soon becomes more decided; is pain, and this pain soon becomes darting and burn- nd aggravated by motion. Associated with this pain is tenderness of the affected nerve-trunk and of the skin

and muscles which they supply; there are also rheumatic
and cramps of the muscles, especially of the calves of the

Motor symptoms are soon added, palsy or inco-ordin
or both; they are seldom absent in acute cases. The
shows itself, generally, first in the arms, next in frequen
the legs. Whichever of the limbs (arms or legs) presen
first symptoms suffer in greater degree throughout, and it

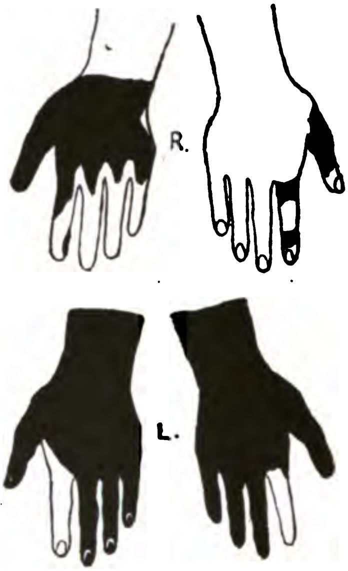


FIG. 50.—SHOWING THE DISTRIBUTION OF ANÆSTHESIA IN A CASE OF LE
NEURITIS. (After Gowers.) The black areas indicate the loss of sensation. I
dorsal and palmar surfaces of the right hand; L, those of the left hand. A r
thrust through the skin produces no sensation.

be alone. The feet suffer more frequently than the ha
In the arms the first muscles to suffer are the extensors of
wrist and fingers, affecting chiefly the muscles supplied by
musculo-spiral nerve. In the leg the first muscles to su
are those supplied by the anterior tibial nerve. The mus
affected waste, become weak and tender, and lose their exc
bility. The faradic irritability is lost, the nerve presenting
reaction of degeneration. In the majority of cases ther

of the knee-jerk, although, in rare cases, it may still per- The muscles below the elbow or knee may be almost rless when those above are scarcely affected.

severe cases the disease may run into complete palsy of imb, extending to the trunk muscles, diaphragm, and atory muscles, and cause death in less than two weeks. her cases the disease may pass into a chronic condition ing months for convalescence.

e first sign of improvement is a diminution in the pain, æsthesia, and tenderness of the muscle. The motor returns slowly; first in the muscles affected last and least, fterward in those paralyzed and wasted in a greater e. In the latter the weakness lasts for many months, and ening of the opponents of the most affected muscles is occur. As a result of the unequal palsy, there may be a acture of the unaffected muscle, causing the well-known tion of foot-drop or wrist-drop. In the ataxic form, times called "pseudo tabes," inco-ordination is the chief tom. When the inco-ordination is the chief symptom, tion is very little affected, but there is soon a loss of motor r.

ataxia from *tabes* there is no loss of power, but the cters are affected and the patient has a sense of constric- round the trunk, and the reflex action of the pupil is often while in neuritic ataxia these conditions scarcely ever exist; the trophic changes differ. In tabes the bones are ged and the joints are diseased, but not so in neuritis; while lossy skin in neuritis is never met with in tabes. In the ic type there are vasomotor changes. The skin becomes ened, glossy. There may be effusions into the joints, ng an arthritic adhesion; especially is this true of the -joint (the fingers may become bloodless and white).

thology.—In multiple neuritis the nerve-fibers are the of the inflammation; while in isolated neuritis the in- ation is usually confined to the nerve-sheath. In ple neuritis the inflammation extends to the myelin and axis-cylinder, causing their destruction. The nerve-undergo acute degeneration similar to that described « "Degeneration." The myelin and axis-cylinder of the aff fiber become, at first, segmented; subsequently more o disintegrated and studded with new nuclei; and finally abs to a greater or less extent, leaving the sheath empty. terminal plates in the muscles also undergo degenera becoming granular and finally absorbed. The muscles sup by the nerves affected undergo certain changes; they be paler than normal and smaller in size; the fibers are reduc size. Normal fibers may be found side by side with those are degenerated. In the majority of cases it is the fibers are affected chiefly, or even exclusively; the connective t and sheath suffering very little.

A parenchymatous multiple neuritis may give rise symptoms which not long since were supposed to be wl spinal in origin.

One of the most important steps in recent pathology is differentiation of this affection, due to lesion of the periph nerves, from those of lesion of the spinal cord. No doubt m diseases that heretofore have been reported as dependent u a spinal lesion were due to multiple neuritis.

Diagnosis.—In the earlier stages the diagnosis is someti difficult. It may simulate some of the organic spinal disea or might possibly be mistaken for rheumatism; but the t ling in the extremities, the cutaneous and muscular tenderr and early development of muscular weakness disting the disease from rheumatism. Bilateral wrist-drop or f drop is also indicative of multiple neuritis. The symmetr development of weakness in corresponding muscles of op site sides, chiefly the extensors of the forearms and the co sponding muscles of the legs, associated with hyperæsth and deep tenderness, is the chief diagnostic symptom.

Prognosis.—Should be guarded. In a severe case paralysis may extend to the respiratory muscles, caus death. But generally a complete removal of the toxic ca ed by judicious treatment, will result in a restoration of nctions of the parts affected. But time is an imporctor; you will not be able, in the majority of cases, to liately arrest the disease, even after the withdrawal of use. It may continue to increase in severity even for after the disease has been stationary; the cause having topped, the danger to life is not great. After the dis- s reached its height, it is followed by a stationary period, lasts for one or two months, before marked improve- begins. The process of regeneration is slow, requiring hree to six months or more before the extensors regain ower; some cases may require from one year to eighteen s to recover their normal action.

ite.—Numbness, tingling, and formication in the limbs; of coldness in the parts, or the opposite, a sensation of e of temperature, with heaviness, aching, and drawing; shooting, tearing, or lancinating; pains unbearable lly at night; patient restless and moaning; great anguish, e is especially useful in the acute stage of neuritis caused direct influence of cold.

a rac.—Severe pains, with numbness as if the nerve had ompressed; aching pains in the limbs, which the patient to the toothache. This remedy is especially useful in le neuritis the result of the use of alcohol.

ricus.—Burning, itching on both hands, as if frozen; ot, swollen and red; violent ulcerative pains in the limbs, prevents sleep; twitching of the muscles; extreme wake- and restlessness.

ica.—Stinging and pricking in the affected parts; parts if bruised by blows; twitching of the muscles. Neuritis ult of injury to the nerves.

nicum.—Tearing, burning pains in the limbs, particularly joints, with pale swelling of the affected parts; dull ach- in worse at night after becoming warm in bed; violent, , and jerking pains from the tips of the fingers into the er; burning, tearing pains, with great restlessness, obliging the patient to move the limb often in order to obtain r nightly aggravations of the pain; worse about midnight; somewhat relieved by warm applications, and by rubbing affected parts. Arsenicum is especially useful in mu neuritis where there is emaciation and withering of the aff parts, followed by paralysis.

Belladonna.—Severe, lancinating, burning pains, aggra by the lightest touch, but frequently relieved by steady sure; cannot bear the clothing to touch the part; heavines a paralytic feeling in the affected part; the parts red, sw and tender to the touch; pains relieved by warmth and letting the affected limb hang down.

Bryonia.—Pressing, tearing, cutting pains, worse from tion, better from lying on the affected side; pains of an ing, cramp-like, and bruised kind; parts red and swollen painful to pressure, but often relieved by hard pressure and cold water.

Dulcamara.—Stitching, drawing, and tearing pains in limbs; sensation as if the limbs were going to sleep; lo sensation and icy coldness of the affected parts. Neuritis exposure to intense cold and wet.

Ferrum phos. and Kali chlor.—In rheumatic neuritis t two remedies have given me better results than any c remedies, especially if the joints were implicated. In the stage where there is fever, which in many respects resembl aconite fever, where the parts affected are hot, throbbing, ful, and very sensitive to the touch, and where the tong red and swollen, or where it has a red line along the ce ferrum phos. is the remedy. Kali chlor. is called for in second stage, when exudation has taken place and the to is covered with a white or gray fur.

Hypericum perf.—Painfulness and soreness of the affe parts; attack generally brought on by change of weather. ring claimed this to be one of the most important remedie neuritis, the consequence of external injury; when the ne have been lacerated, wounded, torn; wounds by nails or spli

eet or hands; injuries of the nerve attended with excru-
pains; sharp cutting pains darting along the course of
ve and terminating in a twisting or wrenching sensation.
iid that if hypericum is taken internally and applied
lly, it will prevent lock-jaw from wounds in the soles of
or of the fingers and palms of the hands. Many cases
cute and chronic neuritis have been cured by its use.

phorus.—General neuritis; subacute neuritis, with numb-
d a feeling of constriction in the extremities; feel-
of a tight band around the body; paralysis following
re to cold and dampness.

tox.—Tingling, burning pains, or drawing, tearing
1 the limbs; the pain attended with numbness, formica-
nd a paralytic feeling; great restlessness, with inclina-
move the affected parts; pains worse during rest and
irst commencing to move, but better from continued
and from dry heat. Rhus is especially useful in neuri-
result of getting wet or from lying on the damp ground.

grav.—Burning, corrosive pains, worse in damp, cold
r, and from cold applications; the painful parts are sore
aten whenever touched.

urther therapeutical treatment see " Brachial Neuritis "
ciatica."

ddition to prescribing the indicated remedy, there are
neasures equally necessary. The cause, if such exists,
e removed, the limb must be kept quiet; abstinence
ovement is of great importance; it is better for the
to be confined to his bed. The limbs should be kept
tion so as to guard against deformity. The foot-drop
e contracture of the ham-string muscles are to be
lly guarded against. The next step is to keep the limb
This relieves the pain and hastens the reabsorption of
lammatory products that may have been thrown out.
of the best methods for accomplishing this object is to
ot linseed meal poultice along the course of the nerve.
ng the limb in envelopes of wool or cotton may answer

the same purpose. It is necessary to guard against burns may readily occur in this disease from the application of Heat that may be tolerated without any discomfort normal condition may be sufficient in the disease to c blisters or ulcers; again, in case there is much anæsthesia, will have to be on your guard, or you may cause ulcers to f These ulcers may last for months and are very troublesom heal.

Electricity.—Electricity is of the greatest value in all of injury to the nerves and, in many cases, will assist in gi relief.

In many of the less severe cases, electrical treatment is s cient of itself for the restoration of the normal condition.

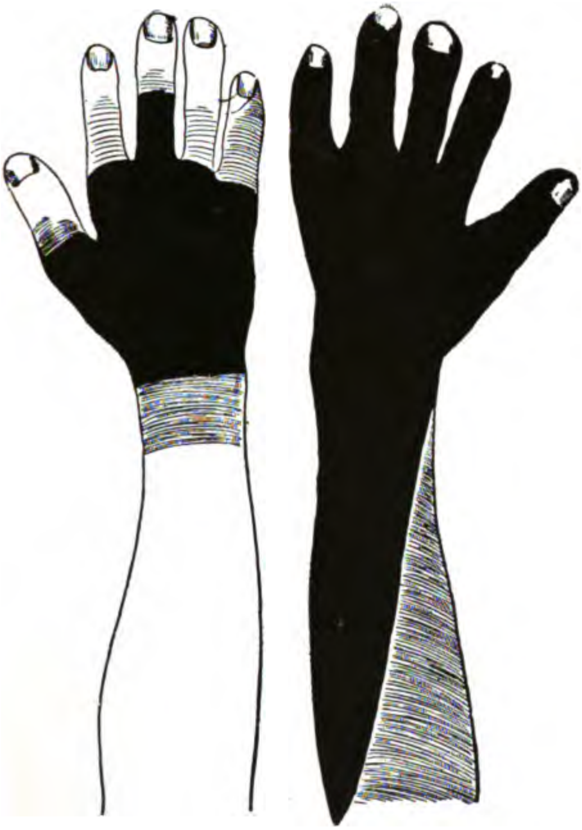
You should use the galvanic current. Apply the nega pole over the inflamed nerve and the positive at some indi ent point. Never use the faradic current in the acute st In the chronic stage, after the acute inflammatory sympt have passed, the faradic current or static sparks should be u especially if there is any wasting away of the muscle, or contracture.

Erb advises galvanization of the spinal cord, and, as muscles of the upper limb are those most commonly affectec carries this out by the application of the positive electrod the region of the cervical enlargement, and the other to sternum, using a current of ten to twenty-five milliampe stabile, for two minutes, the direction is then reversed for same period, and the paralyzed muscles are then galvani with the negative electrode, labile, and a fairly strong curr for two or three minutes, the positive electrode remaining the nape of the neck.

For further particulars in regard to the electrical treatm see "Electrical Treatment of Peripheral Paralysis."

Morvan's Disease.

In 1883 Dr. Morvan, residing in a little town in Britta published a paper on a disease that he had observed there,



51, Plate XII.—Showing the Trophic Disturbances which Occur
e Hands in Morvan's Disease.—The fingers are thickened and club-
d. The black indicates the area of loss of sensation, pain, and tem-
ure.

he gave the name of analgesic paresis and panaritium of perior extremities, or pareso-analgesia, but to which the Morvan's disease has since been given.

s is a very rare disease, characterized by a slowly prove paralysis, circumscribed atrophy of the forearm or muscles, loss of sense of pain and sensation of heat, and c disturbances, as evidenced by the formation of cuta- fissures and felons or whitlows.

affection has been met with in both sexes, but more ntly in males. It occurs more frequently in early adult

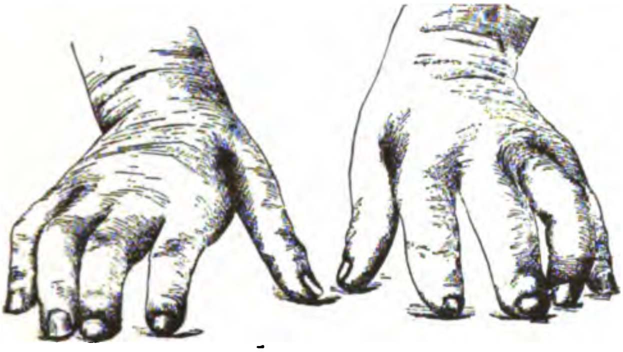


FIG. 52.—SHOWS THE DEFORMITY OF THE FINGERS.

Traumatism has, in some instances, been supposed to an exciting cause.

symptoms come on slowly. There is muscular weak- f the hands and forearms, accompanied by severe pains. deep palmar fissures and felons make their appearance. felons or whitlows are usually painless—can be cut open ut the patient evincing the least degree of pain. One of rminal phalanges may necrose. Occasionally the trophic bance precedes the anæsthesia, and the whitlows and are then painful. Both upper extremities are usually ed; one, however, is usually affected some time before her.

In rare instances it affects the lower extremities; but i
never been known to affect the body. There is loss of s
tion to pain and temperature, while the sense of tact
muscular sense are either altogether unimpaired or very sli
affected. The electrical irritability slowly disappears a
disease progresses.

Pathological examinations show that there is a neuri
the parts involved in the disease.

The progress of the disease is slow but progressive, exte
over many years; yet there may be remissions and appar
some improvement.

The treatment is only palliative.

Tumors of Nerves.

The nerves, like the brain and spinal cord, are subje
morbid growths. The term "neuroma" has been ap
indiscriminately to all morbid growths situated on the ne
The true neuroma consists of nerve-fibers. They are invar
the result of an injury to the nerve, causing a solution of
tinuity of the nerve-fibers. From the end of each old
several new fibers grow, turning, twisting, and gro
upward. A well-known example of these neuroma are
tumors which form on the divided extremities of the nerv
the stump left after an amputation.

Other varieties of tumors are fibroma (which are the
common variety affecting the peripheral nerve), sarcoma,
carcinoma. Another form of tumor affecting the nerv
the gumma, due to syphilis. These gummy tumors a
most frequently the cranial nerves within the skull, but
rare elsewhere. The nerves principally affected are the c
the olfactory, the third, fourth, fifth, and sixth.

The treatment of neurotic tumors is not medical, excep
those which are of syphilitic origin, and those require
syphilitic treatment; all others require excision.

If the tumor is located on the side of the nerve, it ma
removed with very little risk; but if it infiltrates the n

ıce itself, that portion of the nerve affected will have to sed and the ends of the nerve brought together. Before ıg to this operation you will have to consider the risk of anent loss of function of the nerve. In multiple neuro-ırgical treatment is out of the question.

Nerve Degeneration.

erve-fiber undergoes the structural change known as ieration" whenever it is separated from the cell from it springs. As a rule, the degeneration takes place in ection in which the nerve-fiber runs, with the exception sensory fibers in the peripheral nerves.

trophic centers of most of the sensory nerves are the ganglia in the posterior roots. A few, however, have rophic center in the peripheral nerve-cells. Degenera-curs in the motor nerve when the cells of the anterior ire destroyed; hence these cells are the trophic centers motor nerves. Degeneration is commonly termed " sec-," because it is dependent upon a "primary" lesion of r kind as division of the nerve. Degeneration may llow a compression or overextension of the nerve.

symptoms of nerve-degeneration are those of sudden or l loss of the nerve-functions, such as paresis, paralysis, esia, and various trophic and vasomotor disturbances; ss of reflex action in the area of the distribution of the iffected.

eneration in the motor nerve is attended by changes in trition of the muscles which it supplies. These changes ence in about fourteen days after the primary lesion. ange in the muscle consists of atrophy of the primitive li of the muscular fibers, with occasional areas of fatty ration, excessive neuclear proliferation, and cell-accu-on in the interstitial connective tissue.

o regeneration of the nerve occurs, the muscular fibers ılly disappear; fibrous tissue takes their place, and slowly cting permanent shortening may result. If, however, regeneration of the nerve occurs, the muscular chang arrested and the normal condition of the muscular fi slowly restored.

If the lesion is in a nerve that contains sensory fib causes loss of sensation in the part supplied by the nerv as it causes motor palsy. But a slight lesion of a mixed may cause permanent paralysis, and sensation be unaf or impaired only in a slight degree and for a short this is due either to the fact that the sensory fibers r more readily, or that a slight degree of conduction suffice for the stimulation of the sensory centers in the and not for that of the muscular fibers.

In other cases the nerve may be completely divided ar cause no loss of sensation; this is due to an anasto between the terminal fibers of different nerve-trunks.

The histological change found in the nerve consists granular lumpy degeneration of the medullary sheath, l ning within a few days after the lesion of the nerve. T followed by softening of the axis-cylinder, which is substi by protoplasmic masses. This is accompanied by nuclea liferation of the sheath of Schwann and cellular accu tion in the neurilemma from which young connective tis developed. The entire nerve is permeated with this formed connective tissue.

Ranvier suggests that this excessive cell-proliferation follows loss of function in the axis-cylinder is due to lo power which the axis-cylinder normally possesses to re the vital energy of the cell elements. The newly formed nective tissue is not entirely absorbed, but remains to a gr or less degree as an evidence of the nutritional disturb which have taken place in the nerve.

Regeneration is a unique process, in that the nerve is the specialized tissue that can grow again after being destr Nerve-fibers present a remarkable power of growth. Ra has shown that from the end of each old fiber several new

, only one of which probably persists. In the divided mity of a nerve in the stump after an amputation we will in instance where the nerves grow out, turn back, and form ths varying from the size of a bean or larger. The nerve s grows from the central end when atrophied or perfor- The fibers of the central stump grow into the nerated peripheral fiber.

man nerves cannot be made to unite physiologically, but anatomically. (Dana.)

generation occurs when the mechanical obstacles to the of the divided fibers are not too great, and when the heral nerve is not too greatly atrophied.

animals new fibers may grow through a considerable t of structural tissue between the divided ends of a nerve, n man it is doubtful whether regeneration of a divided occurs unless the extremities are brought in contact, or st in close proximity. (Gowers.)

he ends of a divided nerve are brought quickly into perfect sition, secondary degeneration does not occur. Simple on appears to be a less serious injury than the temporary cement of myelin in a contusion.

generation is, as a rule, an extremely slow process; it re- s from six to eighteen months or even longer to insure a lete restoration of a nerve-fiber after the fibers have been usly impaired by a degenerative process. As the new cylinder grows out from the peripheral of a nerve it mes inclosed in new myelin sheath and neurilemma. n regeneration of a nerve occurs, the trophic activity is manifested in the improved nutrition of the muscles; then ws a return of voluntary power, and finally restoration of electrical irritability. If the wasting of the muscles has considerable, a long time will elapse before they regain normal size, if ever. They are usually somewhat smaller the corresponding muscle of the unaffected side.

Anæsthesia.

Anæsthesia is a loss of tactile sensibility.

Analgesia is loss of sensibility to pain.

Anæsthesia of the pain sense of muscles is called l muscular sensibility or muscular analgesia. (Dana.)

Thermo-anæsthesia is a loss of sensibility to temperatur

Paræsthesia is a term applied to all morbid sensations as numbness, prickling, formication, etc., except pain.

In some cases all the different kinds of sensations ar but in others only one or two of them are gone, while the remain intact. Thus common sensation may be impai lost, while the sensation of temperature and locality acute as ever. Anæsthesia may be complete or partial perfect absence of mere sensibility or a mere benumbing

Anæsthesia may arise from disease of the brain, spinal or of the peripheral nerves. Any lesion or condition nerves which tends to impair or destroy their ability to co sensation to the nerve-centers (such as wounds of the supplied by that nerve or nerves), large doses of Indian poisoning from lead or arsenic, rheumatism, and exposu intense cold may act as causes.

In the parts affected with anæsthesia the nutrition i active and there is a feeling of numbness, or it may be a ling or pricking sensation, a feeling as if ants were cra over the skin. The patient may not be susceptible t alternation of heat and cold; hot bodies applied to the skin feel cold, or cold bodies hot. Frequently the circulati the skin is retarded, causing a lividity or discoloration o surface; or there may be just the opposite conditio unnatural whiteness and shrinking of the skin, due to v motor spasm. The conducting power of the nerve ma impaired—not enough to cause complete abolition o senses, but sufficient to cause a perceptible interval (va from one to thirty seconds) from the time an impression (prick or a hot or cold object) was made on the terminal the individual becomes aware of the fact; this condition wn as *delayed sensation*.

re may be a loss of power to distinguish slight differences ght, from the fact that the sense of pressure upon the diminished or abolished. If, however, the difference be the muscles will detect it independently of the sense of ous pressure. The sense of touch may remain and that be abolished, or *vice versa*.

scular anæsthesia is frequently combined with inability to nine the extent of any movement or the position of the when the eyes are closed; it may or may not be associated utaneous anæsthesia. This condition is met with in hysnd locomotor ataxia.

gnosis.—This depends very much upon the *cause* and lity to remove it. If it is due to cerebral or spinal lesions are able to remove them, then we relieve the anæsthesia. to a division of the nerve which supplies that part, by g the nerve we restore its function; but if any considerortion of the nerve has been destroyed, the case is hope- If due to pressure from a tumor, by removing that we the anæsthesia, but not always immediately, for even the cause is removed, it sometimes takes a long time complete restoration takes place.

atment.—The treatment of anæsthesia is similar to that or paralysis. The cerebral anæsthesia, which sometimes in paraplegia, is usually not permanent, and it may often de to disappear by a few applications of the faradic brush affected areas. Where there has been any degeneration nerve, the galvanic current will be the one to use, ally the interrupted galvanic current.

Hyperæsthesia.

eræsthesia is an exalted sensibility of the skin, mucous rane, and even of the deeper structures. The seat of the lity is ordinarily in the skin in the distribution of the

cutaneous nerves. It indicates an irritation of the nerve
distributed to the region affected.

Hyperæsthesia may be caused by tumors pressing up
pons Varolii and corpora quadrigemina, or by alteratio
injuries of the posterior columns of the cord. It may
to cerebral or spinal meningitis. But the most co
causes are an impoverished condition of the blood and hy
any condition that causes a lowered vital and nervous
Sometimes hyperæsthesia is caused by rheumatism, go
lithæmia.

We find hyperæsthesia associated more frequently
spinal than with cerebral disease. It may afford va
information respecting the spinal segments that are ir
by some destructive process within the adjacent regions
spinal cord, or it may point to the existence of some local
of irritation of that nerve itself.

For the treatment of hyperæsthesia, compare " Neu
in General."

Neuralgia in General.

Neuralgia (pain in a nerve) is a functional disease c
terized by pain in the course of a nerve or nerves, which u
develops in paroxysms either spontaneously or after pr
upon certain points. When there is organic disease
nerve itself, such as neuritis, the disease cannot be, in the
sense of the term, called neuralgia. Many times such
ditions are wrongly diagnosed as "neuralgia." It is
difficult, and sometimes impossible, however, to draw the
absolutely and say that all on this side are neuralgia and
the other side are neuritis.

A peculiarity of a neuralgic pain is that it may shift fro
nerve or set of nerves to another. Every nerve of the
may be the seat of a neuralgia at one time or another.
essentially a disease of adult life, and occurs more frequ
in women than in men.

Neuralgia may be idiopathic—that is, developed sp sly or symptomatic of some cause acting centrally or herally. It may be caused by exposure to cold and damp- metallic poisoning (especially of mercury or lead), mias- (malarial) influences, pressure on the nerve from tumors course, or from inflammatory exudations (especially in eighborhood of the bony orifices through which the nerves their exit), and periostitis and caries of the adjacent . Central causes, such as structural changes (tumors, ning, sclerosis, etc.) in the brain and spinal cord and their branes, may produce the most severe and the most ctable of all forms of neuralgia. Chief among the general s are anæmia and general nervous debility. Neuralgia o those causes may be said to be the cry of the nerve for r nourishment. The tendency to neuralgia is often litary; that is, an individual inheriting a neuropathic con- tion is more subject to the various forms of neuralgia. x irritation constitutes an important factor in the pro- on of neuralgia. Syphilis is a frequent cause of a dis- ng and obstinate form of neuralgia.

e chief symptom is pain. The pain usually runs along the se of the nerve from above downward, and is not only felt e point of irritation, but usually throughout the whole se of the nerve and its several branches. The pain usually ns suddenly, is of a sharp, darting, boring, stabbing, or ing character, and is always more or less paroxysmal—that ne pain is of greater intensity at certain times. The xysms may be separated from one another by complete missions, or merely by remissions. In the intervals there be no pain, or it may be simply a dull ache. In some nces the intervals between the paroxysms of pain become orter and shorter duration, until finally the pain becomes st continuous. In those cases which are due to the rial influences the paroxysms of pain occur at the same each day or alternate day as the case may be.

euralgic pains are increased or brought on by sudden xs, cold or heat, or pressure on the affected part; firm pressure, however, is usually not painful. The pain is usuall lateral; when bilateral, it is almost always symmetrical in bution. In some attacks the pain may shoot to the neighb nerve-areas, as, for instance, in severe neuralgia of the nerve, the occipital nerve may also be the seat of a distr pain; or, again, in other cases the pain, after it has persist some time in an intense form, may shift from the nerve pr ily affected to the areas supplied by the neighboring bra

Reflex motor complications, manifested by twitching jerkings of certain muscles, are apt to occur in the more forms of neuralgia. If the neuralgia affects a mixed nerv motor spasms are usually confined to the distribution nerve; but when the nerve is purely sensory, the motor festations are reflexed to adjacent areas. Associated wit pain there may be a sense of tingling, numbness, and col of the affected part.

Hyperæsthesia and anæsthesia in the distribution o affected nerve are frequently met with. Vasomotor com tions may occur. The skin in the region of the distributi the affected nerve may be red and hot, or, on the other may be pale and cold. Trophic changes are liable to o The skin may become rough, thickened, or take on an er latous character; the hair may become coarser and more b and have a tendency to fall out. If the neuralgia is sever of long standing, the hair in the region of the distributi the affected nerve may become gray.

The hair frequently changes its color during the parox and is restored during the interval. (Putzel.)

Secretory disturbance may occur. Puncta dolorosa observed in the majority of cases. This term, "pu dolorosa," refers to the circumscribed painful spots, sitʋ along the course of the affected nerve, which may be disco by pressing carefully with the fingers along the course o nerve. They are most frequently found at the points at w the nerves emerge from their bony canals and foramina; a level where the nerve emerges from a deeper structure—th

point where they pass through the firm aponeurosis to a
icial level; in the region in which important cutaneous
divide, or where they anastomose with one another.

ssure upon these localities during an attack of neuralgia
ces severe pain at the site of pressure, and may also
luce the pain in a corresponding nerve. There are some
in which the puncta dolorosa only appear during the
ysm and are absent at other times. The prognosis
ralgia depends upon the primary affection to which it
.

nite.—This remedy is indicated in recent cases, especially
re is febrile irritation, great restlessness, and severe
ing pains; unbearable pains, especially at night; pains
ating or a sharp shooting pain, which follows the
of the nerve; pain so severe as to almost drive the
t to despair; numbness and tingling in the affected part;
vith thirst; pulse full, hard, and rapid; violent congestion
affected part. Toothache even in the sound teeth; with
ing in one side of the face; pain mostly left-sided or going
ight to left; pain insupportable; the patient almost beside
lf, tossing about with agony; intense redness of one cheek;
stion to the head. Aconite is especially useful in neuralgia
limbs (upper or lower) with numbness as if the blood
t circulate freely; also in neuralgia resulting from sudden
of perspiration or caused by dry, cold wind.

ea racemosa.—Pains like electric shocks here and there;
lancinating pains in various parts, associated with ovarian
rine irritation; severe pains down the arms with numb-
s if a nerve had been compressed; numbness of the whole
especially of the arms; severe pain in the back, down the
and through the hips, with heavy pressing down. Actea
ecially useful for neuralgia from reflex uterine irritation,
er it be the nerves of the head, chest, or limbs that are
ed; sensation of heat on top of the head just back of the
r; a feeling as if the top of the head would fly off; sharp
ating pains in and over the eyes. The actea pain is worse

at night, rather than during the day; the patient wants t
the open air.

Allium cepa.—Especially useful for neuralgia following
tations or injuries of nerves, characterized by fine, threa
shooting pains. This remedy has been found almost a s
for " neuralgia of the stump" or when the pain arise
a nerve having become imbedded in a cicatrix.

Arnica.—Stinging and pricking in the affected parts
restlessness so that he has to stir about constantly; wors
noise or from the slightest exertion. Neuralgia sharp a
a nail or knife; all pains worse on motion. Neuralgia f
ing injuries to nerves; intermittent with a malarial basis
coldness or fever; burning, stinging, tearing pains with a
and bruised feeling in the affected part, with great sen
ness to any kind of touch.

Arsenicum album.—Burning pains; the parts burn lik
great anguish and fear of death, with great restlessne
exhaustion; pains nearly drive the patient crazy; pains co
in paroxysms; the affected parts feel cold; neuralgia i
brain as if it were torn to pieces; pains worse during r
night; relieved by exercise, by external warmth. Arse
is especially useful in malarial neuralgia recurring perio
and where it has resisted all other remedies.

Belladonna.—Pains coming suddenly, lasting a long
shorter time and then suddenly disappearing; pains lan
ing, burning, tearing, and splitting; or pains of a thro
character; associated with the pains there is twitching of g
of muscles, especially of the facial muscles; pains worse i
afternoon and evening; daily paroxysms from noon till
night. Belladonna acts best on the right side when the p
aggravated by light, heat, noise, and motion, particularly
stooping; better when sitting up.

Bryonia.—This remedy is indicated in the acute at
especially in rheumatic constitutions, or when caused by
with sharp, stitching, or shooting pains; pains aggravat
night or by the least motion; better when lying on the af
side.

sicum.—Violent pains in various places; now here, now pain in the face, partly like bone pain, excited by external ; partly like fine pains piercing the nerves, which are tor- ng on falling asleep; pains more stitching than tearing; during rest and from the slightest draft of air, whether or cold; better on motion. Capsicum is especially suited ients of lax fiber and especially fat people.

sticum.—Lightning-like pains darting from place to terrible sensation of tearing; paroxysmal; pains often g forward, then remitting, again starting from the same Neuralgia moving from the occiput, upward and for- over the vertex; dull drawing and tearing in the arms ands; drawing in the thighs and legs, knees and feet; worse in the open air, better from warmth of bed.

ron.—Cedron has neuralgia returning at precisely the hour each day; malarial neuralgia, when the attacks with clock-like regularity.

mnomilla.—Drawing, tearing pains which become intol- at night, and especially aggravated by the warmth of the excessive sensitiveness to pain, so that the least pain nes unbearable; patient suspicious and easily angered; and irascible; face puffy, one cheek red, the other pale; erspiration of the head and hair.

ffea cruda.—Pains unbearable; feels perfectly discouraged; and throws himself about; great sensitiveness and pain of ffected parts; tearing pains in the flesh and cellular tissue, r than in the bones; coldness of the limbs; of the hands eet; of the body; extremely violent neuralgic headache, ms as if the brain were torn to pieces, the patient unable ar the pain; it seems as if a nail were being driven into the Neuralgic toothache with intolerance of the pain; ed only by holding ice-water in the mouth; great agita- and restlessness; overexcitement of the entire nervous m, worse out doors; great mental and physical exhaus- lassitude, and general debility.

cculus.—Great hyperæsthesia of all the senses and an

exalted susceptibility to impressions; extreme irritabil
the nervous system, especially of the spinal cord; the le
or motion is painful; great lassitude of the whole body, i
exertion to stand firmly; faintness from the slightest exe
cannot lie a moment on the back of the head; forced to
the side.

Colocynthus.—This drug affects the nervous system p
fully, and is useful in neuralgia of various parts of the sy
especially useful in the crampy pains affecting the abdo
viscera. The pains are griping, cutting, or are of a sho
tearing character, and are aggravated by the least mo
worse at night and when warm in bed; drawing, tearing, p
ing pains in the whole abdomen; pains as if the bowels
in a vise, with cutting pains downward; intense gri
cutting or squeezing in the intestines as if they
being squeezed between stones; pains relieved by
pressure against the abdomen; tearing or drawing pains
the limbs; violent neuralgic headache, cutting or bo
better from pressure; facial neuralgia about the eyes,
on the left side; great soreness and yet relieved from pres

Dioscorea.—Dioscorea acts through the ganglionic ner
system, chiefly upon the solar plexus, particularly affecting
umbilical region; giving, as its most characteristic e
severe pain, simulating a so-called "bilious" colic; its
point of action is upon the spinal nerves, causing pain ove
body and in the viscera, also reflex pains; griping, cut
twisting pains in the epigastric and umbilical region,
flatulency; colic generally relieved by walking about; w
lying down, at night; relieved by pressure like colocynth
the colocynth pain is confined more to the abdomen, whi
dioscorea it generally radiates from the abdomen to the
into the chest and arms; pain in every part of the body, sh
ing and cramp-like; sharp pains in various parts of the
darting from one part to another, worse in the evening;
generally relieved by motion in the open air; great desire t
in the open air.

emium.—Acute, sudden darting and shooting pains single nerve branches in almost any part of the body or with contractions and twitchings of the muscles supplied affected nerve. Neuralgia of various nerves, with loss trol over the feet; pain in the muscles of the back, hips, ɔwer extremities; the pains are mostly deep-seated; ıe general nervousness and loss of control over the ary muscles, giving rise to odd, irregular actions.

ıtia.—This remedy is more particularly indicated in those ɔf neuralgia occurring in nervous females, especially when led or accompanied by chilliness or shivering. The t is of delicate, sensitive, peevish, excitable, hysterical, ıs temperament; oversensitive to pain; great sensitive- f the skin to a draft of air; great weakness and exhaustion he whole body, also great mental exhaustion. Violent, ;ing pains occurring in sudden, short jerks, moment- sappearance of the pain by change of position; pressing rom within out, like from a hard pointed body; pain in circumscribed spots or lancinating stitches as from sharp pains worse after meals, after lying down at night, or morning after getting up; warmth relieves the pains.

hesis.—Nervous exhaustion; nervous aches all over; ling of the whole body; pain constantly changing locality, n the head, now in the teeth, now in the sciatic nerve, led with nervous palpitation. Neuralgia chiefly left- pains worse after sleeping. Left-sided orbital neu- ; rising of heat in the face before, and weak feeling in the nen after the attack. Lachesis is better adapted to thin maciated than to fat persons; or to those who have been ;ed both mentally and physically by their illness.

gnesia phos.—Neuralgia appearing at intervals, relieved ırmth; at times pains in the head, teeth, face, and limbs; cramps in the stomach; lightning-like pains suddenly ıring and disappearing; pains shoot about like lightning the course of nerves, relieved by heat, pressure, and or a jerking, cutting pain, worse when the body gets cold.

Neuralgia which occurs regularly each night, during t
the patient perfectly well. Intercostal neuralgia, of a dr
constrictive kind. Neuralgia every night, now in the
limbs, in the tibia, or in the thighs, now in the left, now
right side, accompanied by spasmodic muscular contra

Lycopodium.—Attacks of severe pains in the stomac
or twice daily, gradually becoming more frequent; pair
stricting or boring, extending into the back, at times bu
stitching, relieved by belching; disappear entirely after
a quantity of thin, acrid fluid; aggravated by the lightes
better at night; constant, dull pain in the epigastrium; l
with faintness; no appetite; white tongue; constipatio
flatulency; emaciation and general debility; gastralgia.

Mercurius.—Drawing, tearing pains, or aching or sta
pains, worse at night in bed and from external warmth; c
tolerate the warmth of the bed; violent, lacerating pains
shoulder-joints, arms, and wrists, worse on motion; t
pains in hip-joint, knee, and femur, worse on motion;
tion of cold in the affected parts; chilliness on going in
open air; chilliness alternating with internal heat; great
ness; hot flashes from the least exertion; constant incli
to profuse perspiration, without any relief; night s
patient restless and sleepless. Mercurius is especially
for where there is a history of a syphilitic taint.

Nux vomica.—Tearing or jerking pains, with twitchi
the affected parts; aching, drawing, or bruised pains i
limbs, worse during motion and at night; violent agon
pain, obliging the patient to change his position frequ
or to walk about; stitches through the body in jerks; feel
all over; violent, contractive, painful sensations throug
whole body; oversensitiveness to external impressions, c
light, noise, or music, a slight current of air, and to tr
ailments. The patient is morose and irritable; bec
angered easily; tongue coated; nausea and vomiting; altern
of constipation and diarrhea; alternation of chilliness and
There is an aggravation of all the symptoms early in the r

after eating, in fresh and cold air, from mental exertion, coffee and liquors; better in warm room at rest, and lying ı; worse in dry, generally better in wet weather. The nt is usually very drowsy early in the evening and wakes in the morning, 4 a. m. Nux is more especially suitable in, irritable, choleric persons, with dark hair, who make mental exertion, sitting up late at night, or who lead a tary life; and to nervous people troubled with indigestion.

ris quad.—Neuralgia of the spine, pain located about the cervical vertebra, extending upward and downward to houlders, with weight, numbness, and heat, with soreness e top of the head, so that he could not brush his hair, ness of eyelids, etc. Neuralgia of the coccyx, a pulsat- ticking pain when sitting, with pain between the scapulæ.

osphorus.—Neuralgia, accompanied by much nervous , especially in nervous and nervo-sanguineous tempera- s; general mental and physical exhaustion, with trembling e limbs. Neuralgia, in many parts of the body, with ia and a broken down, emaciated constitution; pains tear- rawing, tensive, worse in the morning, and excited by the est draft of cold air; body feels bruised, with sensation dness; open air intolerable; takes cold easily in the open Neuralgia of the brain, feeling of a rush of blood to the general aggravation after washing; shocks in the head, ring a mental strain.

tina.—Neuralgia in various parts of the body. The pains f a cramping character, and cause numbness and tingling parts affected; cramp-like pains, in the legs; in ears; in ose; at the root of the nose; in the malar bone; in the pos- muscles of the neck. The parts affected by cramp-like are painful to pressure, as if bruised. Tingling pains, feeling of coldness and numbness of the affected side; pain- eling of numbness, as if the parts were between screws; l, numb sensation as from a blow, here and there, especially head, always in small spots. The pains increase gradually lecrease just as gradually as they came; uneasy, general restlessness, "fidgety" in the limbs, worse at rest; sensat if the body was growing larger.

Pulsatilla.—Neuralgia of various parts; wandering which fly from one part of the body or limbs to another, and sharp, and attended by bruised, sore sensation; te lancinating, pulsating pains only on one side of the body not sit long at a time; must walk about to relieve the p the pains continue they become more and more unbea pains usually associated with chilliness; pains worse in the ing, worse when lying down at night; during rest; in a room; better in the open air. This remedy is generally cated for persons who have a mild, yielding disposition, in to weep; or for those who incline to be very gloomy and t of care.

Rhododendron.—Erratic, tearing pains in the limbs; r in forearms and lower legs; pains seem to be seated in the or periosteum; drawing, tearing pains in the periosteum are mostly confined to small spots, and reappear on char weather. These pains may affect nearly every part of the and are frequently associated with coldness of the especially of the feet; but the general indication is *aggra before a storm;* pains worse at night, when at rest, a wet, stormy weather; relieved by warmth, when eating for some time afterward.

Rhus tox.—This is one of the most reliable remedies in complicated with rheumatism, or when aggravated by weather; drawing, burning, tearing pains; tingling or ulce pains mostly brought on by exposure to wet. The pa attended with numbness, formication, and a paralytic fe great restlessness, inclination to move the affected parts to change position frequently; pains worse during rest and first commencing to move; better moving about, and dry heat.

Sepia.—Lancinating, stitching pain; must get out o for relief; pains worse from rising but better from slow wal pains jerking upward like electric shocks, or boring pains;

in the morning immediately on waking, become very se, and gradually decrease until in the afternoon they h; aching, drawing pains, worse in the left side and at ; pains are burning, worse after eating, from washing, at rest; also worse before menses; general aggravation a day, morning and evening; great exhaustion, the least ion fatigues, even going up stairs; general languid feelf the whole body; debility, usually characterized by painful tion of emptyness at pit of the stomach; icy coldness e feet and hands. Periodicity is a marked symptom, ially in the female sex, to which this remedy is especially ted; delicate, sensitive females, particularly when the menl function is disturbed. Especially suitable for persons dark hair.

igelia.—Tearing, shooting, stabbing, jerking, or burning ting pains in all directions, suddenly coming and going; usually left-sided; pains generally beginning at one point adiating in different directions. The pains begin in the ing with the sun, increase during the day, and dih toward evening; pains worse in damp weather, from ure and motion, and from any noise or from jarring of the ; usually worse in change of weather, especially in stormy her. The neuralgia is attended with paleness of the face, tation, and oppression of the chest.

lphur.—Intermittent, periodic neuralgia lasting twentyhours, worse generally at 12 m. or 12 p. m.; worse ummer or midwinter. Associated with the neuralgia may be sensation of heat on the top of the head, cold feet, a sinking or weak feeling in the epigastrium, this being ially worse in the forenoon from ten to twelve. The nt is excessively sensitive to the open air; very much ed to take cold. This remedy is especially useful in ic cases when other remedies relieve, but do not cure; also e there is a psoric tendency.

art says that this remedy should be thought of in all very nate cases, especially when the capillary circulation is very weak, and the general tone of the system much lo It is also specially adapted to cases arising from the s suppression of urticaria, or any other form of cut eruption, and also when complicated with hemorrhoi constipation. It is particularly suited to people with complexions.

Tarantula.—This remedy is indicated in hysterical tions, when the pains are of a spasmodic, cramping c ter, attended with nervous excitability, anxiety, restle cardiac oppression, weeping, and a profuse discharge of the patient cannot keep quiet in any position; great re ness and agitation, particularly of the inferior extremitie to change position; constantly moving the hands, fee head.

Veratrum album.—Violent, drawing, tearing pains, d the patient to despair, or causing prostration and fai drawing, tearing pains, with pinched features, cold swea great thirst; great nausea; vomiting and diarrhea, or obs constipation; rheumatic pains, like electric jerks, worse fro of bed, better walking about; attacks of sudden faintnes trembling of the extremities. The pains of veratrum in and subside gradually, and are attended with marked co of the extremities, great exhaustion, and a cold perspir

Verbascum.—Violent pain, jerking, like lightning, pressive, numbing pain, aggravated by pressure, sne talking, or a draft of air; neuralgia appearing at the same every day, 11 a. m. till 4 p. m., or a periodic neuralgia, ap ing twice a day, the same hour in the morning and afte each day.

Electricity.—In electricity we have a valuable agent fo ing not only temporary but also permanent relief in ma the most obstinate forms of neuralgia.

In the majority of cases galvanism will prove more ficial than either faradism or static electricity.

In neuralgia, when pressure over the affected nerve a vates the pain, the galvanic current will be the one to ch

firm pressure gives relief and does not increase the pain,
radic current will be the one to employ.

ıen using the galvanic current, place the positive elec-
over the painful spot, or, if the painful area is quite
sive, move the electrode gently over the entire region
ed; the negative pole is placed at some indifferent point.
with a very mild current and increase the strength gradu-
Often the pain will be aggravated at first, but will
ally subside as the treatment continues.

en, when the neuralgia is superficial, temporary relief
ıg from three or four to twelve hours) can be quickly
ıed by saturating the sponge of the positive electrode
a solution of cocaine (ten per cent.), aconite tincture,
lleborine. Aconite produces a deeper analgesia than
ıe, but the objection to its use is that it causes severe
ing around the edges of the anæsthetized area. This,
ver, can be prevented by the employment of equal parts
caine (ten per cent. solution) and aconite. Helleborine
or five drops of a one per cent. solution on the sponge of
ositive pole) produces a deeper and more lasting anæs-
than cocaine, and is never followed by any constitu-
effects, as occasionally follow the employment of
ne.

e application of the static sparks will in many cases not
give temporary relief, but also cure the neuralgia. If the
lgia is located about the head, face, or any sensitive
n, it is better to employ the wooden or carbon electrode,
ey produce a milder spark and are less painful than the
ball electrode.

Paralysis.

the term "paralysis" we mean a loss of the power of
on (the term paralysis is sometimes used to indicate loss
y kind of function, as paralysis of sensation or secretion).
ght, incomplete, or partial paralysis is termed "paresis."
lysis may be general or may be partial. It may affect the

majority of the voluntary muscles or be limited to one m It may be confined to one limb or a group of mus monoplegia; to one lateral half of the body—hemipleg affect only the lower half of the body—paraplegia. In instances the paraplegia may be confined to the upper h the body. It may affect both the upper and lower ext ties—a double hemiplegia or diplegia.

Paralysis may be sudden or gradual in its mode of onse may be temporary or permanent. Anything which ten impair the generating power of nerve-centers, or the ducting power of nerve-fibers, may produce paralysis.

The various forms of paralysis may be grouped under headings, namely: 1. Paralysis of Encephalic Origin Paralysis of Spinal Origin. 3. Paralysis of Peripheral O

Paralysis of Encephalic Origin.

(*Brain Palsies.*)

The varieties of paralysis coming under this heading are to lesions within the cranium, such as hemorrhage, embo thrombosis, tumors, abscesses, laceration of the brain-t (the result of fracture to the skull from blows or falls upon head, etc.), disseminated sclerosis, hydatids, and cysticerci.

Hemiplegia not infrequently occurs in persons suffering tertiary syphilis, and is then owing to plugging of the vessels softening, or to hemorrhage. Paralysis of a cerebral origin be of the nature of a monoplegia, a hemiplegia, or a dipl The most frequent form of cerebral paralysis, however, is h plegia, which is generally owing to cerebral hemorrhage, sof ing or embolism of an important cerebral artery. The is generally affected more than the leg.

In hemiplegia the face may be paralyzed on the same sid the leg and arm; or the facial paralysis may be on the oppo side from that of the limbs. This latter form is known "crossed paralysis" of the facial nerve and body type.

In facial paralysis due to cerebral lesions it is the lower e face that is chiefly affected; the upper part of the face, rows, and the eyes are very little, if at all, affected; the eyes be closed, which is not the case in facial paralysis of heral origin; also other cranial nerves are liable to become or less affected; the trunk muscles are rarely ever affected. e may or may not be anæsthesia; if present, it soon passes . There is no wasting of the paralyzed muscles, except natural consequence of the disuse of the limb. In chil- , although the paralyzed limb does not waste much below ize already attained, slackening in its process of growth soon leave it markedly inferior to its fellow. The cters are rarely ever involved. The tendon reflexes, knee- etc., are exaggerated; foot-clonus being readily obtained. e is never loss of faradic irritability. Bed-sores rarely ever e their appearance. Loss of consciousness may or may not ede the attack.

arly rigidity and late rigidity—tonic spasms of the para- l limb or limbs are conditions which make their appearance, er or later, after the apoplectic stroke. Early rigidity lly comes on within the first three days after the onset of paralysis; in rare instances within a few hours.

ifferent authorities differ as to the cause of these early lities. Todd claims that they are due to the "irritative ence of certain brain lesions, or perhaps to a slight secon- inflammatory condition springing up in the tissues around seat of the lesion." This would account for those cases of lity coming on about the third or fourth day, but not for e coming on immediately.

astian claims that the majority of the early rigidities are endent upon the locality of the lesion, as, for example, a n of the pons Varolii, in the optic thalamus, or just outside body, at the posterior extremity of the corpus striatum, especially liable to be followed by early rigidity.

n rare cases hemiplegia comes and goes without either form rigidity appearing. Rigidity has never been known to r in the trunk muscles.

The arms are affected more often and more severely th
legs. When the arms are involved, it is the flexors th
affected; when the legs, the extensors chiefly. Any at
to straighten the limb only aggravates the conditio
spasms become more intense and tremor and pain m
developed.

Late rigidity does not come on till after the elapse of s
weeks. It differs in no way from early rigidity; in fact,
distinction without a *difference*. Dr. Todd originally adv
the idea that late rigidity was brought about by mea
"irritations springing up in connection with the proc
cicatrization taking place at the seat of brain lesion."

Hughlings Jackson claims that "late rigidity is a c
quence of the cutting off of cerebral influence from the af
muscles, and of the consequent unantagonized action
those of cerebellar centers."

Some of these cases of cerebral paralysis recover spo
ously, while others only slightly improve as time goe
Where the hemorrhage has been so extensive as to destr
corpus striatum nearly altogether, or where the lesion is
ated in the knee and the anterior third of the posterior di
of the internal capsule, the paralysis will be complete an
manent; but where the extravasation of blood is s
absorption may take place in time and the paralysis disa
to a greater or less degree. Where the hemiplegia is
ciated with total loss of language (aphasia), the prog
is decidedly unfavorable as regards recovery of the voice.

A slight impediment of speech (thickness, huskiness,
often yields to treatment, but aphasia never. (Althaus.

Paralysis that is complete at the end of three month
remain considerable in degree for the rest of life. When
bral paralysis is advanced to the stage where "spastic
plegia" is developed, treatment rarely does any good.
an extensive laceration of cerebral substance has taken
either by hemorrhage or softening, or when the shrinki
the cyst has caused rigidity of the paralyzed muscles, the

as regards the relief of the paralysis is unfavorable. theless, notwithstanding the apparent hopelessness of of these cases of hemiplegia with rigidity, perseverance in ient is rewarded by a measure of success.

condition sometimes following hemiplegia, of cerebral , is that known as *athetosis,* which is in reality only a form of post-paralytic chorea. This affection is characl by an incessant movement of the fingers and toes, and being impossible for the patient to keep them in any position whatsoever. It has not, however, always such gin. Bastian says that occasionally it may follow some convulsive attack without paralysis.

Paralysis of Spinal Origin.*

ial paralysis is due either to primary lesion of the anterocolumns and the gray matter, or it comes on secondarily affections of the spinal meninges and the vertebræ. It e the result of traumatism, falls, or blows on the back; hemorrhage, embolism, thrombosis, myelitis, tumors, pri- sclerosis, and caries of the vertebræ. It may follow id fever, suppression of habitual discharges, or after pro- iemorrhage, as in *post-partum* hemorrhage. It may be sult of exposure to cold and dampness, or the consequence ieral anæmia.

alysis of spinal origin may come on suddenly or gradually. sion producing the paralysis is, in the greater majority of bilateral. If the lesion be seated in the lumbar portion cord, the lower extremities will be paralyzed—termed legia. In rare instances the lesion may involve the cervigion, in which case the upper extremities are paralyzed espiration and deglutition are interfered with.

spinal paralysis the intellect and the nerves of special remain in their normal condition; consequently there is ss of consciousness, nor are the cranial nerves involved;

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or the special types of spinal palsies, see "Diseases of the Spinal Cord."

there is no facial paralysis; the sphincters of the blad rectum are more or less involved; common sensibility may not be affected, but, as a rule, anæsthesia is more c and permanent in spinal than in cerebral paralysis; the irritability may or may not be affected; nutrition seriously impaired; there is usually early and marked of the paralyzed muscles; in the majority of cases b make their appearance, sooner or later. Twitching muscles of the limbs, and especially of the fingers and an annoying symptom met with quite frequently, o especially at night, and may be so severe as to interf sleep. There is a symptom (namely, the girdle sens sensation of constriction as if a band were tied around th that, when present, is pathognomonic of a spinal lesi

The degree of improvement that will take place in a spinal paralysis, will depend, first, upon the size of the that is, upon the number of motor cells that are des second, upon how much of the function of the destroy will be assumed by the remaining cells.

In cases of mild character, recovery will be comple when there is much damage to the cord, paralysis may complete throughout life, and associated with the p there are spasms and wasting of the muscles. In lesion ing the gray matter of the anterior horns, followed by ea complete loss of the faradic irritability, wasting and p will generally remain. It is rare, however, for all th of a muscle to be completely destroyed, and by pe stimulation, by means of electricity, the remaining fibe be greatly developed, so that a limited amount of moti be obtained. In those cases in which the muscles are n contracted, but the muscles themselves have und changes, so that, instead of muscular structure, they re fibrous cords, the deformity and paralysis will be perm When electrical reactions are normal, it indicates a para slight and temporary form. In spinal paralysis, commo bility returns much more quickly than the motor power, a few weeks, or, at farthest, a few months; occasionally, er, it is permanent.

Paralysis of Peripheral Origin.

chief causes of peripheral paralysis are inflammation rheumatic, etc.) and injuries. Injury to the nerves, gunshot wounds, pressure from tumors, the use of es (in crutch paralysis the musculo-spiral nerve is chiefly d, being compressed at a point where it winds around the us between the bone and the transverse part of the); from the head resting on the arm during intoxication hol, or in patients who are under the influence of chloro- and especially may this occur among soldiers in camp, e accustomed to sleep on the damp ground, using their r a pillow. It may involve any nerve or set of nerves cerebro-spinal system.

form of paralysis is, as a rule, not difficult to diagnose, for son that the paralysis is limited to the muscles or groups scles supplied by particular nerves; if a mixed nerve, in on to the loss of motion, common sensibility is impaired over the area supplied by that nerve. The faradic and ic reactions are altered within ten to fourteen days. The lar contracility to the faradic current is lost early, to a r or less extent, and the formula of degeneration is ped by using the galvanic current. Within fourteen to en days, atrophy of the paralyzed muscles begins and g proceeds rapidly.

prognosis of peripheral paralysis depends essentially its cause, and in those cases where the cause can be ed, and where the wasting of the muscles has not pro- d too far, and there is still reaction to the faradic current, can be expected in a short time. If, however, the es are much wasted, the disease has existed for a long time, ne muscles refuse to respond to the applications of either nt, the prognosis is unfavorable, though a cure may

possibly occur. In cases of complete wasting of the r
following paralysis, it is useless to expect improvemen

Electrical Treatment of Paralysis.—In every c
paralysis that comes to us there will arise the question
electricity do any good in this case? and if so, what for
be used? The amount of benefit to be expected from the
electricity and the form of current (galvanic, faradic, or
to be used, depends entirely upon the pathology of the
ent cases. Every case of paralysis will not be benefited
use of electricity. In cases of paralysis of long standin
to destruction of a large area of the nerve-center (br
spinal cord) electricity will do little if any good, and may
aggravation by its use; but in those cases where it is indi
it will give brilliant results; for it is in the treatment
various forms of paralysis that electricity has won its gr
laurels.

Electricity is used, first, to endeavor to cause absorpt
the inflammatory or hemorrhagic products, in order to re
the cause of the paralysis; second, to preserve the nut
of the muscles by keeping up their physiological activit
means of the artificial stimulants, thus preventing them
atrophying. For, as Hood says, wherever function is
performed there is an excess of arterial blood, which r
growth, thereby preventing atrophy, and if we can caus
muscles that are paralyzed to perform artificial function b
use of electricity it prevents their atrophy and increases
growth. It is well known that peripheral applications also
very beneficial effects upon the central lesions by reflex a
The effect which peripheral stimulation exerts upon
central organs plays an important part in the electrical
ment of paralysis, and cures have been affected even whe
treatment has been applied only to the paralyzed parts.

So often in the treatment of paralysis, electricity is l
upon as a remedy to be brought into use after all els
failed. This is a serious mistake, for electricity is one c
best curative agents in the earlier stages of paralysi

ıt of the power of causing reabsorption of the inflam- y and hemorrhagic products of the lesion.

paralysis of cerebral origin the treatment should be ed to the seat of the lesion, so as to promote the proc- the absorption of the clot. The process of absorption erally finished within thirty or forty days after the .

uestion of great importance is, How soon after the attack the electrical treatment be commenced? Remark has nended to galvanize early the sympathetic and the cere- ructures on the side opposite to the paralysis, in order to the absorption of the clot. Onimus and Legros say that ization of the brain and sympathetic may be commenced the seventh or eighth day after the attack. Althaus hat it is absolutely necessary to suspend the galvanic ent until the danger of cerebral fever which so often an attack of hemorrhage should have passed off, and it occurs, comes on in the second or third week. It is safe, however, to begin the treatment from the four- to the twentieth days, according to the nature and y of the case. In a mild case, the treatment can be sooner than in a severe case, and in one in which there nptoms of a secondary stroke. The treatment should delayed beyond this period, for it lessens the prospect nate recovery.

y the *galvanic* current should ever be applied to the cere- misphere; the negative pole to be applied over the seat lesion, and the positive over the nape of the neck. with a mild current. *Shocks must be carefully avoided.* tting should be continued from five to eight minutes, and ed twice or three times a week. The *faradic* current *never* be applied to the brain during the acute stage. d faradic current has no effect on the nerve-centers, an injudicious application of a faradic current of a high of power to patients who have suffered from cerebral rhage is liable to bring on another attack.

In paralysis of spinal origin electricity in the acut must be avoided. In the subacute stage the galvanic should be used, the negative pole placed directly over of the lesion, the positive pole at some indifferent poin should be applied every day or every other day, accor the indications, using a mild current.

In those cases of spinal paralysis where reflex a excessive, as indicated by twitching and spasmodic the limbs, fingers, and toes, electricity in any form not be used, as it causes an aggravation of the spasms.

In paralysis of peripheral origin only the *galvanic* should be used during the acute stage. Place the negat over the inflamed nerve, and the positive at some ind part.

In a case of paralysis, whether of cerebral, spinal, or pe origin, after the acute inflammatory process has subsid treatment of the muscles should be begun with the fara rent, providing that this current will produce contractio paralyzed muscles; but in a case where the faradic curre to produce any muscular contraction it is useless to a The galvanic current should be used until the musc again respond to faradism. The paralyzed muscles ar treated by applications of the negative electrode, whic be well moistened, and moved slowly and firmly o affected muscles; the indifferent electrode is to be plac the cervical or lumbar region of the spine. Each tim applying the galvanic current, the faradic current sho tried, and just as soon as it will produce contraction muscles, it should be used in preference to the galvanic c The paralyzed muscles can be faradized directly by th cation of the active electrode over their surfaces, or in by its application to their motor nerves—that is, to the points; in either way similar results are obtained. Wh paralyzed muscles do not react to faradism, and nerve-de tion is present, its persistent use is liable to aggravate t by strengthening the opposing or non-paralyzed muscl ıstening deformity by undue overaction of those , for it must be remembered that healthy muscles are, as ıcreased in strength faster than the diseased ones by the ·atment.

ch cases the galvanic current should be used. The : current has power to improve nutrition and ıen, even though it does not produce contraction, and be given by labile application until reaction returns or : is found to be incurable. When the muscles fail to either to faradism or galvanism, the galvanic irrita-ı some instances, may be restored after a few applica-the sparks from the static machine.

e the nerves and muscles of the affected side are equally e to electricity as those of the healthy side, the galvanic is more useful than the faradic. Althaus lays down the principle that when the electro-muscular excitability al, galvanization of the peripheral nerves is indicated; is diminished, faradization. It is often useful, how-combine the two or to use them in succession.

nterrupted galvanic current in some cases serves as an to other treatment in restoring the power to paralyzed . It is possible, by means of the interrupted galvanic ions, to preserve the nutrition of muscles even though ılysis remains unimproved.

ı there is very much contracture of the muscles, the ion of *static sparks* will often prove of valuable service; ere there is much atrophy of the muscles, the fine applied by means of the *roller*, will in many cases start ition in the paralyzed muscle more quickly than any ɪrm of treatment.

:miplegia, when the muscles contract more readily he influence of electricity than in health, electricity, if all, should be in the form of a very mild faradic current. ı using faradism, no attention need be paid to the n of the current. Place a long, flat electrode on the er the lumbar plexus, if the lower limbs are paralyzed,

or over the cervical plexus, if the upper limbs are paraly
then apply the other pole to each muscle successively.
alyzed muscles are to be treated by applications of the
electrode; which must be well moistened and move
and firmly over the affected muscles. The indifferent e
must be placed over the cervical or lumbar region of th
The current should just be strong enough to pr
moderate contraction of the paralyzed muscles. Each
should last about ten minutes, and be repeated twice
times a week, according to the nature of the case.
using galvanism, however, attention must be paid to th
tion of the current. The current is to be run in the d
in which contraction is to be obtained with the mildest
for example, if we find that by placing the positive pol
and the negative pole below it requires a stronger cur
produce a contraction than if the poles were reversed, w
use the latter arrangement. Or, in other words, t
selected to be used on the motor points should be the on
causes the greatest contraction.

Contractions can generally be produced by placing o
over the motor point and the other a little above; or o
can be placed at either end of the muscle and the
reversed by means of the pole changer. Hood* advis
in addition to the local use of electricity to the
the centers for the muscles be connected with the
passing the current in the natural direction of the
force. This will compel vibration along the natur
to the muscles, so that as soon as the center libera
motor impulse the nerve is in condition to conduct it.

The static usually surpasses all other forms of electri
dealing with stiffened, contracted, or paralytic muscles.
benefit which will often follow this form of treatment
most obstinate cases is one of the most surprising thi
electro-therapeutics. In paralysis of the extremities,

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* Dr. C. T. Hood, "The Treatment of Paralysis by Electricity," *Medical*
March, 1893.

contracture and stiffness, apply the negative direct the muscles affected.

e " static induced " current we also have a most powerit in the treatment of paralysis. The advantage of this current over general faradization, or the interrupted current, is that it produces more readily muscular conis even to a great degree, and without causing the t pain or disagreeable sensation to the patient; also in x action it has proven to be strongly tonic, not only to ve itself, but to the whole system as well. Its method cation is as follows: If it is the arm that is paralyzed, e negative electrode held to the palm of the hand, and e positive pole go over thoroughly the motor points of scles of the shoulder and arm. If it is the leg that is ed, place the negative electrode to the sole of the foot ly the positive to the motor points of the muscles of thigh, and hip. In this way contractions of each muscle p of muscles can be readily produced.

he anæsthesia which is associated with the various forms ysis the faradic wire brush will prove invaluable. The should be as strong as can be tolerated, and conrom three to five minutes. The other electrode may be at any indifferent point. In some instances the sensipermanently restored after two or three applications. " combined current " (galvano-faradic) is chiefly of in overcoming trophic disturbances, which often manimselves in connection with motor paralysis.

ienne found that certain forms of paralysis received enefit from electricity when the application was accomby what he termed " mental gymnastics "; that is, when tient exerted his will to produce contractions of the ed muscles at the same time that a current was passing h them.

les the improvement of the paralysis in these cases, the health always improves. The whole nervous system ometimes to be reorganized.

Aconite.—Aconite is called for in the acute stage
affection causing the paralysis. The indications callin
employment are: Head hot, a full and slow pulse, or so
an accelerated small thready pulse; great thirst and
ness; painful sensitiveness of the body to contact; num
the lips and tongue, numbness and formication of th
numbness of the small of the back, extending into th
limbs; icy coldness and insensibility of the hands and fe
ling, commencing in the feet and spreading upwar
vulsive twitchings or convulsions of the whole body;
suddenly falling down senseless, followed by paralysis
limbs; congestion of blood to single parts, causing gre
tiveness and finally paralysis; paralysis, the result of com
of the cord, caused by congestion; paralysis accompa
coldness, numbness, and tingling. Unless there is tin
the affected part aconite is seldom indicated.

Belladonna.—Great restlessness, sudden starting;
co-ordination of the muscles of both upper and lowe
paralytic weakness of all the muscles, especially of t
paralysis of the extremities, especially of the righ
paralysis of the muscles of the eye and iris; paralysis
right side of the face; paralysis of the tongue, diffic
swallowing or of entire inability to swallow; complete or
plete paralysis of the bladder, with or without incon
of urine. Belladonna is especially useful in the earlie
of paralysis where severe congestive symptoms are still

Agaricus.—Paralysis of the lower limbs, with slight
of the arms; paralysis of the upper and lower extremiti
incipient softening of the spinal cord; trembling and c
of the hands, nails blue; formication in the upper an
limbs; limbs feel as if gone to sleep; limbs cold and blue;
pains in the paralyzed parts; numbness and twitching
parts; paraplegia from congestion of the lumbar part
cord.

Aluminum.—Inability to walk except with the eyes o
in daytime; when eyes were closed, whole body tottered

iness of the limbs; can scarcely drag them; soles of feet when walking, as if soft and swollen; arms and legs heavy; lassitude of limbs; involuntary movements of single parts; and tired, must lie down; slow, tottering gait; constipa- inactivity of the rectum, even soft stools require great ing because of torpor. Defective assimilation and tion are forerunners of paralytic affections and over these sses this remedy has a wonderful control.

nica.—Head hot, with rest of the body cool; pulse inter- nt, irregular; heaviness of the limbs; twitching of the les; parts feel as if bruised; feet numb and insensible; sis, in consequence of exudations within the brain or cord. Arnica is one of our chief remedies in the earlier s of paralysis, on account of its great power to reproduce orption of the extravasated blood. It is not only suit- n paralysis depending upon cerebral exudations, but like- n any other form of paralysis depending upon exudations kind.

s mel.—Twitching on one side of the body, while the is paralyzed; twitching of the eyeballs; œdema of the feet gs; effusion in the joints; perfectly powerless, cannot take of anything; has to be fed and nursed; the whole lower nity numb and heavy as lead; legs and feet pale and atous and emaciated and cold to the touch.

enicum.—Paralysis, especially of the lower limbs; twitch- embling, and weariness in the limbs; numbness and sensa- f weakness in the small of the back; arms and hands feel ; feet, hands, and fingers feel as if swollen and stiff; great sness, especially at night, with sleeplessness. Chronic attended with great dyspnœa and anxiety.

onia.—Incomplete paralysis; weariness and stiffness of wer limbs; great weariness in the thighs, can scarcely go ps; painful stiffness of the knees with stitches, especially moving them; great lameness, and a desire to keep quiet; ess in the limbs, which seem like lead; paralysis of the generally of both sides. Especially useful in rheumatic

paralysis. Bryonia is an excellent remedy, especially if t
alysis is due to an extension of inflammation from the
and where there is considerable dyspnœa, violent pains
respiration, and difficulty in swallowing.

Baryta carb.—This is one of the most distinguished
dies for paralysis from apoplexy of old people. Gener
alysis of old age, with loss of memory; childish; loss of s
trembling of the hands and limbs; a feeling of debility
whole body; a constant inclination to lie down; tension a
tendons were too short; better lying down; worse standi
tremor of the feet while standing, must hold on to som
to steady himself. Baryta is also a very important rem
facial paralysis of young people, especially where there
alysis of the tongue.

Calcarea carb.—Weakness and lameness of the arms;
ness of the hands when grasping anything; fingers white
and senseless; preceded by slight drawing in them; pa
of the fingers; weakness and trembling in the legs; pa
weakness, not able to walk; paralysis of the extensor m
and formication of the thighs; coldness and deadness
feet, especially at night in bed; sensation as if cold, damp
ings were on the feet and legs; paralyzed in all the limbs
the scalp feels lax. Calcarea is especially useful in those
where the general nutrition is impaired, and where ther
tendency to glandular enlargement; a general sense of
ness and debility; night sweats, especially on the head,
and chest; the skin dry, the hair dry, face wrinkled, an
body generally emaciated.

Causticum.—Causticum is especially useful for pa
states remaining after the apoplexy has been ren
trembling weakness of the limbs; tension and shorten
the muscles, contracting the joints and bending the limbs
sided palsies, especially of flexor muscles; paralysis
deltoid, cannot raise the hand to the head; paralysis of on
trembling of the hands; sensation of fullness in the hand
grasping anything; contraction and induration of the te
of the fingers; drawing pains in the finger-joints, worse at

sis and contraction of the lower extremities; numbness sensibility of the fingers and toes, with ice-cold sensation, tendency to cramps; paralysis of the facial nerve, particu- when it is the result of exposure to dry, cold winds; par- of the upper eyelid, causing ptosis from the same cause. icum is called for in paralysis of the extremities, especially complicated with muscular contractions; and is especially in diphtheritic paralysis. Inability to select the proper is an important symptom calling for the selection of rug.

culus.—Numbness and paralytic feeling in the arms; ant trembling of the hands; hands tremble while eating, e more, the higher they are raised; paresis of the tongue, at he has to speak slowly; paresis of the face and of es of deglutition; twitching of isolated groups of muscles; ness, coming and going; paralysis of the lower limbs, with ss, numbness, and a bruised feeling; paralysis, especially of wer limbs, from the small of the back downward; thighs ralyzed and bruised; the legs cannot be lifted in walking, e dragged along; these sink down from weakness; cold of the extremities, with œdema of the feet; paraplegia ing in debilitated, nervous persons where the circulation eded or sluggish; hemiplegia with numbness, bruised , and stiffness; coldness of the paralyzed parts.

rum.—Cuprum is one of our chief remedies in paralysis. g of the arms and hands; can hold nothing in the hands, ject falls to the ground; coldness of the hands, and blu- pearance of the fingers; paralysis of the lower limbs; ing in the lower limbs drawing them backward; spasms amps in the calves; total or partial paralysis of the tongue icated by stuttering or deficient speech; frequently com- ed with unyielding, chorea-like contractions; bladder and n paralyzed. Cuprum has this peculiarity, namely, that otor power is extinct and the paralyzed part grows r, while the nerves of sensation preserve their normal on.

ium.—Paralysis without spasms; paraplegia after con-

cussion of the spine; general spinal paralysis, and that w
generally follows diphtheria; paralysis of old people, espe
of old women; general paralysis of involuntary mu
paralyzing first the peripheral nerves and, finally, the s
column; unpainful limbs.

Dulcamara.—Paralysis of the arms, with icy coldness,
the patient had been stricken with apoplexy; paralysis o
tongue; of the bladder; paralysis from suppressed eruptio
from exposure to cold. It is suited to beginning of such
but not when the trouble becomes chronic.

Gelsemium.—Paralysis of various groups of muscles a
the eye, throat, chest, sphincters, and extremities; para
aphonia, or speech thick and heavy; difficulty in swallo
complete relaxation of the whole muscular system, with e
motor paralysis; trembling of all the limbs; gait stagge
lower limbs feel as heavy as lead; numbness, tingling, p
ing, and crawling sensations in the limbs; limbs cold;
alysis, more or less complete, of the sphincter ani, an
some cases, partial prolapsus of the rectum; loss of pow
the bladder, especially in old people, or following diphth
incomplete paralysis of the bladder, the flow intermittent
the patient seems not to empty the bladder; great dro
ness; loss of sight and general prostration. Gelsemiu
especially called for in functional motor paralysis, and in d
theritic paralysis.

Nux vom.—Incomplete paralysis of the upper and l
extremities, affected as if asleep, and heavy as lead; sensa
of sudden loss of power of arm and lower extremities in
morning; power of motion not entirely gone but impede
painful twitchings and spasmodic contractions whenever
affected part is moved; when walking, legs tremble; unst
gait; drags the feet; the paralyzed parts feel cold, are b
and emaciated; paralysis of the lower limbs, from o
exertion, getting wet, sexual excesses, or after apoplexy;
alysis of the bladder in old men.

Phosphorus.—Paralysis from softening of the brain; dull

head; wearied, tired feeling all the time; numbness of
iole body, accompanied by pricking sensation; paralysis
al origin; tingling and formication in the affected limb,
from friction; heat in the paralyzed part; twitching of the
jerking of single muscles; legs weak; stumbles easily or
missteps; heaviness and paralytic sensation in the hip-
worse when commencing to walk after sitting, better
alking a little; tingling and tearing from the back down
limbs; paralysis of the limbs. Phosphorus is indicated
functional paralysis that may come from fatigue or from
emotions; also where there is nervous debility, with
lammy sweats or a profuse perspiration.

nbum.—General or partial palsy, with excessive wasting
muscular tissue; loss of motion and sensation; wrist-
from paralysis of the extensor muscles of the arm; par-
extending to other parts of the body, always involving
tensor muscles in preference to the flexors; paralysis com-
with atrophy of the affected parts; coldness of the
d parts; inability to get them warm; paralysis preceded
ntal derangement and trembling; pains in the atrophied
alternating with colic; semi-paralytic torpor of the
nal tract, resulting in constipation.

s tox.—Great restlessness, inclination to move the
d part; inability to rest in any position but for a moment;
pains in the limbs; pains worse on first movement after
r getting up in the morning; paresis of the limbs with
ng and numbness; cramps in the calves after midnight,
lying in bed, and while sitting after walking; when walk-
e legs feel as if made of wood; paralysis of the lower
of the rectum, and of the bladder; paralysis from
ure to dampness. Rhus is the great anti-paralytic
y and is especially useful in rheumatic palsies.

ca.—A tendency to paralysis and paralytic weakness; an
isceptibility to nervous stimuli; the senses are morbidly
the surface of the body is tender and sensitive to touch;
ggravates the symptoms, and heat relieves. Silica is a

deep acting remedy, and is indicated where there is not defective nutrition of the whole system, but also espec when the paralytic weakness is due to defective nutrition o nerves themselves.

Stramonium.—Paralytic weakness of the arms; the arm e becomes fatigued from moderate exercise, so that everythin holds is allowed to fall; weakness and trembling of the ha paralytic weakness and heaviness, especially in the thigh- knee-joints; paralytic heaviness of all the limbs; worse using the arms or walking, particularly when descend Stramonium is especially useful in functional paralysis ari from onanism, or emotional causes, such as fear, fright, et

Sulphur.—Trembling of the limbs, hands, and feet, weariness and prostration; limbs go to sleep easily; burnin the hands and in the feet; wants to find a cool place for th puts them out of bed to cool them off; cramps in the calves soles, particularly at night; paralysis of both legs, with tota tention of urine, and numbness extending up to the umbili Sulphur will prove useful because it facilitates the actio remedial agents which follow it.

Secale.—Numbness of the extremities; tingling in the b extending to the fingers and toes; anæsthesia of the limbs; p ful tingling like crawling of ants on the tongue; convul twitchings, shocks, and painful contractions; muscular twi ings beginning in the face and spreading over the body; c vulsive jerks and shocks in the paralyzed limbs; painful cont tion of the flexor muscles; complete paralysis with increa reflex action; paralysis after spasms, and apoplexy, with ra emaciation of the affected parts; paralysis of the bladder rectum. Secale is especially called for in paralysis of the lo extremities, where there are involuntary discharges of fæces and urine, and where the paralyzed parts emaciate rapidly, and where there is a tendency to gangrene.

One great difficulty in the treatment of any of these types paralysis is to keep hold of the patient a sufficient length time. At first they are faithful in their treatment, but as ti on, as is the case with most chronic cases, they grow of the trouble and expense, and because the cure is not y they will stop.

Post-Diphtheritic Paralysis.

htheritic paralysis is a sequel of diphtheria, generally g on in the second or third week; in some instances, how- it may not make its appearance for a month or two. the diphtheritic process has affected the throat, or other us surface, the patient may have to all appearances fully ered, being up and around, when the paralysis begins to its appearance. As a rule, the first symptom noticed is ht difficulty in swallowing liquids. This is due to par- of the soft palate, which is usually the first part affected htheritic paralysis.

nay be unilateral or bilateral. When it is unilateral, oft palate is tense and drawn to the opposite side. both sides are implicated, the palate is useless angs as a pendulous mass. Soon there is a change ice. It becomes nasal in tone. As the paralysis pro- s and involves the pharynx, deglutition becomes more lt, and in some cases almost impossible. Liquids are d through the nose, saliva dribbles from the mouth, and becomes at times so difficult and thick as to render the nce almost unintelligible.

htheritic paralysis may affect many muscular groups, but, ule, the paralysis is limited to the throat throughout its e. It may, however, affect the eye muscles, causing smus, double vision, or a loss of accommodation. ionally the upper and lower extremities may become par- l. In rare instances the respiratory muscles may become ed, thus causing serious interference with the respiratory on. Anæsthesia is sometimes present, and occasionally . The loss of motion is often preceded by a pricking tion and formication.

e tendency of diphtheritic paralysis is, as a rule, to spontaneous recovery, unless the medulla oblongata and its r are so seriously affected as to cause death by direct ference with respiratory and cardiac mechanism. In tha death may suddenly result from heart failure or from dys the result of complete closure of the glottis as a conseq of paralysis of the abductor muscles.

Gelsemium.—In diphtheritic paralysis, gelsemium is our valuable remedy; in fact it has no equal in this particular tion. It is indicated where there is difficulty in swallo speech thick and heavy as though the tongue were too lar the mouth; paralysis of the muscles of the eye, causing dro of the eyelids (ptosis), strabismus, and double vision; also plete relaxation of the whole muscular system; paralysis extremities; muscles of the neck; small of the back weak lame; hands and feet numb and tingling; anæsthesia of the affected.

Halbert (*Medical Century*, January, 1895), in an artic diphtheritic paralysis, says: " One remedy in our materia m is of greatest importance. That is gelsemium. In its p ful action on the cerebro-spinal system its clearest action is the medulla and pyramidal tracts. Herein is found its u in motor paresis and in disturbance of the special nuclei. effect is equally forcible upon the vasomotor nerves, ca venous and arterial congestions. Probably its most found action involves the pharynx and larynx, terminati dysphagia and aphonia. Its symptomological features pe to the incipient form of paralysis, showing a marked tend to the trembling weakness of the lower limbs. Its su neuralgia pains point particularly to some neuritis. Pa sensations in the esophagus and difficult deglutition app the first diphtheritic neurosis. Incontinence of the sphin explains its progressive sympathetic influence. Ptosis, ver and dimness of vision, show its ocular action. Above al cephalgic and mental symptoms, which are so expressi its deeper action, makes it still our remedy *par excellenc* neurotic affections from any sepsis."

sis.—Lachesis is especially suited to left-sided par- ptosis on left side; left side of face expressionless; s of left side of velum palate; left-sided deafness and s, or weakness, numbness, and tingling of the left arm . It will be useful in cases involving also right side. d the left side is more especially affected. The two haracteristic symptoms of lachesis are: *that the throat rse from empty swallowing,* and *that the patient feels worse eping.*

odium.—Lycopodium has the same relation to the de that lachesis has to the left.

ntum metallicum.—Anæsthesia of the roof of the mouth ces; swallowing difficult; has to force every mouthful he esophagus; stiffness of the muscles of the neck; loss e.

icum.—Burning, tingling in the mouth and fauces; s of the oculo-motor muscle with its accompanying ms, viz., dilatation of the pupils, drooping of the upper sis), turning out of the eye, immobility upward and ard of the eyeball; paralysis of the right side; paralysis of er extremities.

ia.—Kalmia is a remedy that always should be thought *re there is threatened paralysis of the heart muscles*— ilure. Associated with this there is usually difficult and sed breathing, with a sensation as if someone squeezed oat with the thumb and finger.

tricity.—Good results have been obtained from both vanic and faradic currents in the treatment of diph- paralysis.

well says that he prefers the faradic to the galvanic in these cases. If, however, the latter is employed, ld be used not to excite contractions in the paralyzed s, as is often advised, but without interruptions. In this exerts a more beneficial influence over nutrition, and has dency to exhaust the returning power of the affected s.

In using the faradic current the applications may be
directly to the paralyzed muscles, or it may be used in the
of general faradization. When the applications are to be
directly to the throat muscles, a pharyngeal electrode sl
be used. Where there is threatened paralysis of the res
tory muscles, a strong faradic current should be applied an
quently repeated, or the patient will die of apnœa.
peculiar mechanical effect of the faradic current seems to
a special influence over diphtheritic paralysis wherever loc
and greatly accelerates the progress of recovery.

Diphtheritic paralysis yields readily under the proper a
cation of static electricity. As a rule, the patient shoul
given positive insulation for about ten minutes, followe
negative direct breeze and sparks for five minutes each to
parts affected by the paralysis. The static *induced* current
often prove of great benefit in these cases; its method of a
cation is similar to that of the faradic current.

Lead Paralysis.

(*Lead Palsy.*)

One of the most frequent toxic causes of paralysis is
effect of lead. Previous to the appearance of the paral
there are usually symptoms present indicative of lead poison
such as a blue line on the gums, frequent attacks of lead c
jaundice, etc., the paralysis being one of the later symptom
the poisoning. This form of lead poisoning is particularly
ble to occur in painters. The paralysis, as a rule, deve
slowly, but in rare instances the onset may be sudden.
premonitory symptoms are slight numbness and tremor in
parts affected, followed by paresis. These symptoms g
increasing until there is eventually complete loss of pow
paralysis.

Lead palsy attacks with preference the upper extremi
Generally both arms are affected, and it is almost exclusively
extensor muscles of the hand and forearm which suffer, w

xors either escape completely, or only become weakened
ıoderate degree. The muscles attacked waste away, and
ere cases the back of the forearm appears hollow, due to
ıy of the extensors; the ball of the thumb wastes away,
it a flattened appearance. As a consequence of the
ıy of the extensor muscles of the forearm, there is devel-
a condition known as "wrist-drop"—that is, the hand
down and there is an inability to raise it again. In
ne cases there may be loss of power to raise the arm from
de, on account of paresis or paralysis of the triceps or
d. The extensors of the lower extremities may become
ed; also the muscles of respiration.

cases of lead palsy the excitability of the muscles to the
c current is always diminished and often entirely lost.
ion of degeneration develops in the paralyzed muscles.
ility is generally preserved. Occasionally the poison
upon the brain, and causes, in mild cases, headache,
o, and inability for mental exertion, an irritability and
ssion of the mind, with disturbance of the digestive func-
In a more severe form there may be delirium, con-
ns, and coma. The convulsions may be limited to a
ular part of the body, as the face, neck, or arms, or they
e general. They may or may not be attended with loss
sciousness. The convulsive attacks may closely resemble
of epilepsy. The patient has tonic and clonic spasms,
at the mouth, bites the tongue, the pupils are generally
d and insensible to light, the cheeks and lips are puffed
expiration, and he may pass into a comatose condition.
oma, however, is usually not profound. In a severe case
d poisoning the patient is weak and emaciated, the com-
n is pale, the digestive function is impaired, the breath
y has a peculiar odor, the bowels are obstinately consti-
, and the circulation is sluggish in the affected limbs, caus-
xudations at the joints and painful swellings.

e diagnosis of lead palsy is usually not difficult. The
y of the case (attacks of lead colic, etc.), a knowledge of

his occupation, the peculiar cachexia and the presence blue line around the gums, will make the diagnosis cle

The prognosis is favorable as regards life, unless th complications are too severe; as regards the paralysis, if t alyzed muscles respond to the faradic current, the cure rapid; if they will only respond to the galvanic current, take a longer time. If the muscles will not react to eit faradic or galvanic currents, a favorable result is not expected. When the lead poisoning is the result patient's occupation, he should be advised to give u occupation altogether; otherwise relapses are certain to his return to work.

For therapeutical treatment, compare "Multiple Ne

The electrical treatment should be conducted accord the rules for treating "Peripheral Neuritis"; also "Pa in General."

Hysterical Paralysis.

In this form of paralysis there is no recognizable fo organic lesion of the nervous system. It is, in fact, a fo reflex spasm, due to irritation of the sympathetic nervo tem, either in some organ or part of the body (such as tis, nephritis, stricture of the urethra, disease of the pr gland, of the ovaries, or of the uterus), causing a consta of nerve force, or to a general irritation of the sympa nervous system from an anæmic or impoverished condit the blood. It is met with more frequently in the femal This form of paralysis may come on suddenly from some tional cause, as fright, joy, etc., or it may make its appe gradually and almost imperceptibly. It may attack a few cles only, or an entire limb, or the whole body. It may a the form of a monoplegia, hemiplegia, or of a paraplegi the great majority of cases it is either the vocal cords c lower extremities that are affected, giving rise to *aphon* *paraplegia*. When it assumes the form of hemiplegia, th side is more apt to be affected than the right one.

ıysterical hemiplegia there is a peculiarity in the gait— , in walking; when the paralysis is pretty complete, the lrawn along as if lifeless, sweeping the ground. It is not around, describing the arc of a circle, as in ordinary egia. (Todd.) The loss of power is rarely ever complete. ıtient can move the limb, but when any attempt is made ıd upon it, it gives way.

ther distinguishing peculiarity of the hysterical paralysis there is very little atrophy of the muscles of the affected he paralyzed limb remaining as well developed as the one. In some instances, the limb or limbs become con- l. Hysterical contractures generally come on quickly pear to be permanent, but may disappear as suddenly as ıme. In rare instances they may become permanent, and ıted with it there may be tremor and an exaggeration of lexes, especially the knee-jerk. Except in a case of long ıg, the electrical irritability of the muscles, both to the and galvanic currents, is normal. There is never reac- f degeneration.

diagnosis of hysterical paralysis is generally made by ion and from the history of the case. By exclusion it is that there are no signs of an organic lesion of the nervous ı. From the history of the case it is found that the sub- this form of paralysis usually presents other symptoms teria, as globus hystericus, anæsthesia, etc.; that the par- usually comes on suddenly under the influence of some nd emotion, as anger, joy, or fear, and often after an of hysterical convulsions; that it may disappear just as ıly as it appeared; that usually the motor power is not y lost, the patient being able to move the limb; and finally there is apparently complete loss of motor power, the t under the influence of some powerful emotion or excite- will generally be able to move the limb.

prognosis is usually favorable, unless the affection is icated with some serious organic lesion, either of the or spinal cord. Some cases would get well without any

treatment. These are the cases cured by the so calle
cure " and by the " magnetic doctor." Other cases
well rapidly or slowly, according as the patient's gene
dition is benefited. If the paralysis comes on dur
climacteric, the more or less serious nature of the in
disturbances, and the condition of the patient's general
will have a bearing in making a prognosis. A few ca
resist for years all kind of treatment, therapeutic, elec
otherwise.

The treatment is that for " Hysteria," which compa

Erb's Paralysis.

Erb's paralysis is a form of paralysis in which one
affected, the consequence of injury to the fifth and six
vical nerves. The muscles paralyzed are the deltoid,
brachialis anticus, infra-spinatus, and supinator long
occasionally the extensors of the hand. (Leszynsky.)

This type of paralysis is met with more frequently in
the result of forcible traction on the head and neck
delivery. In adults, injuries, as from a blow or fall
neck, may produce it. Exposure to cold or dampness m
cause it.

In the electrical treatment the galvanic current will
prove of the most service. One electrode should be plac
the lower cervical vertebræ, and the other in the axilla
about five minutes, remove the axillary electrode and a
to the paralyzed muscles, labile, for the same length o

DISEASES OF THE SPINAL CORD.

Diseases of the spinal cord are divided into two cla
namely, focal and systemic.

Focal diseases are, as a rule, inflammatory processes
beginning at any point of the cord, involve contiguous
tures, irrespective of their function; they may, in fact, i
all the structures of the cord. Transverse myelitis is a t
instance of this class.

temic diseases, as a rule, are degenerative processes, ting of a degeneration of the nerve-elements, and an overh of the connective tissue, resulting in a sclerosis; igh by some it is regarded as a chronic parenchymatous mation. It is a disease in which nerve-structures having mon function are affected; while others that have a differinction escape, even though they lie contiguous to the ed structures.

diseases to which the spinal cord is liable are:

Congestion.

Anæmia.

Hemorrhage.

Growths, or tumors.

Inflammation, or myelitis.

Degeneration.

sides the morbid processes to which the cord itself is lia- may be affected from injuries, resulting in the fracture or ation of the vertebræ (usually in the cervical region), thus ng pressure upon the cord; or from injuries in which there t the slightest evidence of fracture of the vertebræ, but cause the so called "concussion" of the spinal cord, may result later in myelitis; also caries of the vertebræ 's disease), causing a compression of the cord, thereby g up an inflammation.

Congestion of the Cord.

e later researches show that congestion of the cord is not mmon as was formerly supposed, and that a large proporof the cases so reported were in all probability the beginof myelitis. The clinical history of each case, combined prolonged observation of the patient, can alone enable exclude organic spinal changes.

Etiology.—Violent and continued muscular exertion; ssive coitus; blows and falls upon the spinal column; itation of the blood to the cord, especially in long coned low forms of fever, where the patient lies on the back continually. The causes which produce myelitis also h tendency to produce this affection.

Symptoms.—The symptoms are those of comme myelitis; a dull, aching pain, increased by the recumbent po and by standing, if the lower part of the cord is affected not augmented by pressure; and occasionally sensations of in the cord; feeling of heaviness and weight in the limb around the loins; numbness, creeping sensations, and wea of the lower limbs, with twitching of the muscles; there m hyperæsthesia along the spinal column; shooting pains dow limbs; and even the girdle sensation may make its appear there may or may not be impairment of the vesical and r functions.

The treatment of this affection, as well as that of the affection to follow (spinal anæmia), is in the main simil that of spinal irritation; as that affection may be cause either congestion or anæmia of the cord; also compare treatment for acute inflammation of the spinal membra " Leptomeningitis."

Spinal Anæmia.

Very little is known in regard to the ætiology and symp atology of spinal anæmia. It may result from ge anæmia, leucocythæmia, exhausting discharges, such as s hemorrhage or diarrheal discharges; or from compres causing a diminution of the blood-supply to limited area from vasomotor spasms of the spinal arteries, due to pe eral irritation, as from the ovaries, genitals, etc.

The symptoms associated with this affection are the aching, or a weakness and a tingling of the legs when wal which may be relieved when lying down; pains in the bac the nature of spinal irritation; waking up during the night cramping and tingling in the hands. Gowers speaks curious symptom, which he terms a " paroxysmal lamen which consists of a sudden weakness and stiffness of one accompanied with tingling and blunting of sensibility, an on attempting to use the limb. The symptoms are sed by an attempt to continue walking, and pass away est of a few minutes, but may return time and again.

Spinal Hemorrhage.

(*Spinal Apoplexy.*)

ravasation of blood may occur between the dura mater e arachnoid, in the subdural space between the dura mater e bone, between the arachnoid and the pia mater, or into bstance of the cord. The extra-dural hemorrhage is the requent; that into the cord exceedingly rare.

al hemorrhage may be caused by a blow on the spinal n, or as the result of some severe concussion, or it may ondary to some morbid condition of the cord, as myelitis, ng, etc. It may occur in connection with small-pox, fever, and typhoid and puerperal fever; severe cons from epilepsy, eclampsia, and tetanus may also be e.

symptoms, as a rule, develop rapidly. There is an acute pain at the seat of the lesion, which radiates upward and ard and into the limbs. Then paraplegia comes on , sometimes within a few minutes; partial or complete sensibility in the paralyzed parts; the sphincters, as a re paralyzed, the urine having to be drawn; bed-sores ntly complicate the case.

e patient survives the first shock, the acute symptoms to subside within ten days and the disease takes the ter of a chronic myelitis.

prognosis is very grave; death may ensue within a few but if the patient survives three or four days, the prosr a partial recovery is favorable. Complete recovery is ever.

treatment in the earlier stages is similar to that of meningitis; the late treatment is the same as that for s.

In the first stage ice should be applied to the spine by
of ice bags. The patient must be kept perfectly quiet
In some cases a surgical operation is advisable; the v
being removed and the clot taken away.

Tumors of the Spinal Cord.

Tumors occur rarely in the spinal cord, but are
located in the meninges. Tumors of the spinal cord ar
frequently syphilitic, tubercular, or of the nature of a gl
the glioma occurring most frequently. The spinal cord
affected by cancerous growths extending from the m
or from the bones of the canal.

To arrive at a diagnosis as to the existence of a tumo
spinal cord is a difficult matter. The case will have
studied as to whether there was a history of a pre-e
syphilis or tuberculosis, or whether there was a sarcoma,
etc., in other parts of the body.

The symptoms are obscure in the earlier stages. Th
those of slow compression of the cord (compression m
The patient notices that his legs are heavy and get easil
there is numbness and pricking sensations in the legs an
the legs feel stiff. Pain soon makes its appearance, and
earlier stages may be mistaken for "rheumatic" pains; bu
it becomes continuous and severe. There are exacerbat
the pains, when they are of a burning, stabbing characte
during the interval between the attacks they are of a du
ing nature. The pain is confined usually to the nerves
at the seat of the tumor. A girdle sensation is frequent
with. Numbness, hyperæsthesia, and later anæsthesia
There may be tenderness of the muscles and hyperæsth
the skin at the seat of the tumor. Spasm of the muscles
back and abdomen is quite frequent. As the tumor gro
compresses the cord, paralysis (paraplegia) comes on
with the loss of motor power there is loss of sensation.
is rigidity of the limbs, exaggeration of the reflexes,

ol of the bladder and rectum, and the development of ores.

e prognosis is bad, except in syphilitic tumors; death ensu-vithin a few months, or, at most, two or three years. ical interference has, however, relieved a few cases.

Myelitis.*

nflammation of the Spinal Cord, Softening of the Cord.)

elitis may be acute, subacute, or chronic. In the acute the symptoms indicating the inflammation come on ly and reach their height within two or three weeks; while hronic form may require several weeks, or even a month or before it reaches its height.

ere are several varieties of myelitis named in accordance their location and cause:

Transverse myelitis is where the whole thickness of the is affected in a small vertical extent.

Diffuse myelitis is where an extensive area of the cord is nuously inflamed.

Focal myelitis is where one small area is affected.

Disseminated myelitis (multiple sclerosis) is where it rs isolated in different parts of the cord; or the inflam-on may involve nearly the whole length of the cord, more intense in some places than in others.

Central myelitis is where the gray matter around the al canal is inflamed.

Polio-myelitis anterior is an inflammation of the gray er of the anterior horns of the spinal cord.

Compression myelitis is due to caries of the vertebræ, l meningitis, and tumors of the spinal cord and canal.

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inflammation and degeneration of the cord, the nerve-elements and their ing connective tissue and neuroglia are the tissues attacked. A primary dis- between these two processes is that in inflammation the process begins outside nerve-elements, in the connective tissue, and only involves the nervous substance rily; while the degeneration begins in the nerve-elements primarily and affects bedding tissues secondarily. A fixed line of demarcation between the two f onset of the two processes cannot in all instances be drawn.

8. Septic myelitis or abscess of the cord.
9. Tubercular and syphilitic myelitis.

Anatomically these various diseases differ widely; path
cally, in the main, they are similar. For this reason muc
is said of one disease may apply to another.

Acute Transverse Myelitis.

This is the most common variety of inflammation
spinal cord (excepting anterior polio-myelitis, which w
described separately), and may be taken as the typical
A description of this form will suffice in the main for the
varieties.

This lesion of the spinal cord is distinctly inflammat
character, and is usually confined to a comparatively li
longitudinal extent of the cord; hence the term *tran*
myelitis.

Transverse myelitis most commonly attacks the dorsa
ments of the cord; occasionally the cervical or lumbar e
ment of the cord is the seat of the lesion. The lesion
frequently commences in the gray matter or at its edge,
extends first laterally, and afterward upward and down

Ætiology.—It occurs more frequently in males th
females, and more frequently in early adult life. Cold, e
ure to wet weather, and lying on damp ground are fre
causes. Other causes are injuries, laceration, bruises, punc
wounds, concussion of the cord, violent muscular strain, s
suppression of menses, gout, syphilis, and acute infectiou
eases, causing a toxic condition of the blood. *Injury* i
most frequent cause, and *syphilis* next.

Symptoms.—The symptoms will vary with the porti
the spinal cord that is affected. In all cases, however
symptoms are of a commingled *motor*, *sensory*, *rectal*,
vesical nature; the particular sensory or motor area th
affected varying with the locality of the spinal cord affect
the disease. The height of the lesions is determined part
the region to which the *cincture* or *girdle pain* is refe

ly by the extent of the motor paralysis or sensory phe-ena; by the absence of superficial spinal reflexes and the ory of the case.

s a rule, the symptoms are bilateral; however, there are ptions to this rule, as in the case of hemiparaplegia. The al symptoms consist of feelings of numbness, usually in the and legs, which seem heavy and weak; or there may be matic pains, referred chiefly to the joints; there may be modic twitching and painful cramps. Pain may be felt in back, but this is not a prominent symptom. The attack begin with a chill followed by a fever; the temperature may up to 102° or 104°; the pulse to 120 to 130. Except in dren, rarely does it begin with a convulsion. In the early e there may be a heavy, lead-like feeling of the limbs; soon eakness (paresis) of the limbs, accompanied by sensory dis-ances, such as tingling in the fingers and toes, or a feeling the fingers and toes had gone to sleep; also a numbness, ling, burning sensation, and formication (a feeling as if ants creeping over the limbs); soon (from a few hours to a days, according to the acuteness of the attack) this ollowed by paralysis more or less complete. The dis-ution of the paralysis depends upon the position and extent he disease.

the majority of cases the legs and lower part of the trunk are affected, because the dorsal region of the cord is the t frequent seat of myelitis. (Gowers.)

Vhen the lesion is in the cervical region, the arms as well he legs are paralyzed. When the lesion is above that point, omplete, death will result from paralysis of the respiratory scles. There may be a partial or complete loss of sensation to the level of the lesion; again, there may be impairment in erent degrees of the sense of touch, pain, muscular sense, temperature. There is one symptom peculiar to and icative of myelitis—namely, the so called " cincture or girdle ing." It consists of a painful sensation about the abdomen chest or one of the limbs, as of an intensely constricting band or string, which will vary in breadth. This correspond the distribution of the nerves which pass through the n focus of the lesion. Its most frequent location is between umbilicus and ensiform cartilage; above it there is gener a zone of hyperæsthesia, corresponding to the distributio the nerves that pass through the irritated portion of the c just above the focus; the zone can be detected by the passag a hot sponge over it when pain will be felt instead of warm The sphincters are usually affected from the first, except in v slight cases, and they often afford the earliest indication of commencing lesion. If the lesion is in the dorsal region, th is usually at first a retention of urine; but after a time, when cord again becomes capable of manifesting to some extent centric functions, the initial retention gives place to inc tinence (overflow) of urine; but if the lesion involves the lum centers there is persistent incontinence from the first. In b cases there is incontinence of fæces, the patient having power of controlling the reflex actions concerned in defecat when they have once been strongly excited. The passage of fæces is unfelt on account of loss of sensation of the muc membrane. The bowels are usually constipated and relie only after the administration of aperients or enemata.

Bed-sores are a common and troublesome feature of myeli They are the result of an irritation or destruction of the trop nerves that govern the nutrition of the skin. They vary degree from a slight abrasion, amenable to treatment, to ulce tion and sloughing, which is almost impossible to heal o They vary in size from a small point up to several inches squ

In a case of complete transverse myelitis resulting in *soft ing* of the cord the following well-marked symptoms present: The lower extremities are completely paralyzed, the abdominal muscles are also powerless. The feet, as patient lies in bed, are extended, so that the instep is in l with the tibia, and often inverted, so that the great toes cr one another. The skin after a time tends to become dry scurfy. The muscles feel cold and flabby to the hand;

aste only to a slight extent (if the lesion involves the region, the muscles waste rapidly and often present the n of degeneration), and continue week after week to nly a small amount, if any, of diminution in degree of ritability to faradic and galvanic currents.

nuscles of the lower extremities may show some slight ity when they are forcibly tapped, and when the soles of are strongly tickled there may be very slight movef the toes. (Bastian.)

deep or tendon reflexes (knee-jerk, ankle clonus) are ly entirely abolished. The sensibility of the limb and runk are completely abolished up to the ensiform area, bove this level the sensibility becomes quite natural. nally there are paroxysms of brief spasms, causing the draw up. This occurs chiefly when the patient is in d especially during sleep. This may be so severe as e the patient when asleep. This clonic spasm usually the flexors of the limbs, and later it may assume the ype, thus causing contracture and shortening of the nuscles. It may be so great that the knees are drawn nst the abdomen and the heels against the nates.

nosis.—This depends upon the extent and location of ons. Cases of very acute myelitis are usually fatal. If ion involves the respiratory center, death is liable to uickly. In other cases, where there are severe trophic ances, as indicated by bed-sores, etc., inflammation of lder is liable to set up, and the inflammation may extend or both ureters, so as to implicate the pelvis of the kidhen minute abscesses may also form in the kidney itself. pearance of bed-sores within the first week is a bad but of still worse omen is the formation of a large and spreading bed-sore in the latter period of the disease. ete and enduring sphincter paralysis is also a bad sign, is an obstinate cystitis.

er the influence of these various conditions the patient's e and strength gradually fail; emaciation proceeds, and

death after a time from sheer exhaustion, aided perhaps b
intercurrent inflammatory affection of the lungs. In ca
live, paralysis of motion and sensation may remain co
for life. Usually sensation returns within a few we
months; the motor power continues absent for a much
time. The paralysis may remain complete througho
though it is rare for there to be no improvement. In c
a mild character recovery may be complete, but whe
is much damage to the cord recovery is often imperfe
some weakness remains, accompanied either by spasm
wasting.

In some cases improvement occurs, slight or considerab
is followed by a relapse, which leaves the patient worse th
first attack; and this may occur again and again, each
being the expression of a fresh extension of the inflam
of the cord. (Gowers.)

Treatment.—The patient should be put absolutely to
a week or two at first, and then let him up for the latter
the day, and gradually permit him to get about again.
is the first consideration; both functional excitation
cord and movement of the spinal column should be a
The patient should be kept off the back, lying either
side or in the prone posture. In some cases, where hemo
is suspected, the application of cold to the spine, by me
ice-bags, is beneficial; it should be applied about ten m
daily, the patient lying on the abdomen. In the majo
cases warmth is better—mush poultice. The bowels (
as a rule, are constipated) should be kept open by the
an aperient or an enema. Care should be taken that no
remains in the bladder (even in incontinence it will be
that an ounce or so remains), for it soon undergoes deg
tion and sets up cystitis.

In cases of incontinence of urine, to prevent the urine
irritating the skin, a quantity of boracic or salicylic abso
cotton-wool, changed as often as it becomes saturated,
of the best means of preventing this difficulty. If c

the bladder should be washed out with an antiseptic
llowed by a solution of hydrastis or calendula.

ıny cases bed-sores will form in spite of the best of care.
ent as far as possible the formation of bed-sores, the
uld be rubbed with alcohol, in order to restore the circu-
nd gallic acid applied, which will constringe the dilated
essels; also an excellent preventive is to bathe the parts
ohol and a weak solution of tannin. An application of
n plaster over any inflamed spot may prove of service
ventive measure. At the first indication of an abrasion
tion should be changed or an alteration made in the
f supporting the part. Cotton-wool is very useful to
pressure from tender surfaces; air-cushions or water-
e also often used, but if there is marked tendency to
changes, the patient should be placed on a water- or
care must be taken that the water be kept at such a
ture that it will not chill.

l-sores form, or if they are "acute" and not preventable,
ould be treated on general principles, surgical or medi-
the case indicates. In many instances electricity will
eneficial in the treatment of obstinate bed-sores. A
ate connected with the negative pole is applied to the
ordinary electrode, connected with the positive pole,
d on the surface near the sore and a mild galvanic cur-
sent through the circuit for five or ten minutes daily.
wn-Séquard recommends the alternate application of
, one of which is saturated with hot water and the other
ld water. This should be done for five or ten minutes
ay. The object of this (likewise the use of electricity)
rease the activity of the circulation of the parts, and to
e the formation of granulations.

mond advises that they should be treated by galvanism
ollowing manner: a thin silver plate, no thicker than a
f paper, is cut to the exact size and shape of the bed-
A zinc plate of about the same size is connected with
er plate by a fine silver or copper wire six or eight

inches in length. The silver plate is then placed in in contact with the bed-sore and the zinc plate on som the skin above—a piece of chamois-skin, soaked in intervening. This must be kept moist, or there is lit action of the battery. Within a few hours the effec ceptible, and in a day or two the cure is complete in majority of cases. In a few instances, however, a lon is required. Wells claims that indolent ulcers from a are best treated by this method.

Electricity has proved of great service in the vario of myelitis, and there can be no doubt that, when inte employed, it has an influence upon their modification, and arrest. The use of electricity in the acute stage avoided; after the acute stage (two to three weeks), ar there is a wasting of the muscles, it is then beneficial up nutrition. It is better to begin with the galvanic the negative pole applied directly over the seat of th the positive over an indifferent part, as the nape of t (provided the lesion is not located in the cervical re over the sternum. (In all inflammatory lesions of the negative pole should be applied over the seat of the les positive to some indifferent part of the body.) This sh applied every day or every other day, according to th tions, beginning with a mild current (5 to 10 millia and increasing the strength of the current as the becomes used to it; but the strength of the current shou be pressed to such a point as to produce pain or any un symptom during or after the sitting. In the later sta where there has been much wasting of the muscles, th current is preferable for starting up the nutrition. The should only be of sufficient strength to produce gentle lar movement; one pole should be placed on an in part, and the other passed over the affected muscle sitting should be from five to ten minutes.

In those cases of myelitis where the reflex action is e (as indicated by spasmodic jerks and twitches of the

:y in any form should not be used, as it causes an aggra-
f the spasms.

;hould be taken as regards the position of the limbs, so
oid as far as possible the development of contractures.
ause as well as the symptoms will have to be taken into
ation in the selection of a remedy.

te.—In the beginning of an attack if due to a cold;
sure; where there is numbness in the small of the back;
:tending into the limbs, accompanied by icy coldness
nbs, with thirst and internal heat; a sensation of sway-
nd fro in the brain, aconite will be the indicated remedy.

rdium.—Sensation of a band around the body; feeling
g in the spine, so that any motion of the body causes
if the plug were sticking still further into the body;
d feeling in the knees, the patient is scarcely able to
eling as if the knees were bandaged.

onna.—Belladonna usually follows aconite, and is indi-
here there is incontinence of urine, pains in the spinal
ore or less motor or sensory paralysis; where there is
lity of the reflex centers as indicated by twitches and
of the muscles.

ricum.—Hypericum is called for in cases due to injury.
roved itself as much a specific in injuries of the nervous
as arnica has to the muscular system.

lus.—The chief action of cocculus is upon the motor
of the nervous system, and would be indicated in
and loss of power in the limbs; a constricted feeling
the body (cincture feeling) accompanied by nausea,
g, and severe vertigo.

rum vir.—This is indicated in the first stages where
re symptoms of acute congestion, as manifested by
ss, pricking formication, paresis, and later paralysis.

m.—This remedy is indicated in the later stage of the
acting as a tonic upon the peripheral extremities of the
It corresponds to diseases of the nervous system as
s to the blood, and is indicated where there is weakness

of the lower limbs, twitching in the volition muscles; t
body jerks during sleep; formication and burning a
spine.

Nux.—Sensation as of a band about the waist; numb
formication along the spine; twitching of the muscl
modic jerking of the extremities; especially indicate
there is a tendency to tonic spasms. Paralysis of t
limbs, limbs cold and without sensation.

Cuprum.—Paralysis of the lower limbs; lower lim
matous, but retain their sensibility; twitching and
of the muscles; twitching in the lower limbs, drawi
backward; hyperæsthesia and great sensibility of th
column; stiff, lame feeling in the back and lumbar
respiration short and oppressed; weakness, prostrati
debility.

Rhus tox.—From taking cold, exposure to dampne
tractive sensation as if the sinews were shortened; n
with tingling and loss of sensibility.

Dulcamara.—Myelitis, the result of exposure to
dampness; cold, chilly feeling in the small of the ba
strictive feeling in the muscles (cincture feeling); dull
in both loins, with sensation as of squeezing from wit
ward, at every inspiration, while sitting bent; stitchin
ing, and tearing pains in the limbs; sensation as if t
were going to sleep; burning in the feet; skin dry,
burning.

Plumbum.—Paralysis preceded by trembling, spasm
shooting, darting, intense tearing pains in the track
larger nerves; atrophy and loss of sensation of the
parts; limbs painfully contracted. Plumbum is al
specific for the cramps which often accompany paralysis.

Chronic Myelitis.

Chronic myelitis may occur as a sequel to acute my
secondary to other local morbid processes, such as tu
the meninges or within the canal, meningitis, caries of t

tebra (compression myelitis), or from constitutional causes, such as alcoholism, syphilis, and gout.

The symptoms vary according to the character and location of the lesion. In many cases they correspond to those of tumors of the cord; in others they are similar to those of acute myelitis, with the difference that they develop slowly and have a progressive tendency, requiring in some cases months and even years to become fully developed. The motor power is usually impaired far more than the sensory. A marked symptom in the majority of cases is an *exaggeration* of the reflexes, the knee-jerk, foot-clonus, etc. A tendency to spasm gradually develops, and increases to the condition typical of "spastic paraplegia." (Gowers.)

Different cases manifest almost every symptom that can be produced by disease of the spinal cord.

Softening of the Spinal Cord.

Softening of the spinal cord is an affection of quite frequent occurrence. It may be inflammatory or non-inflammatory; that is, it may be *secondary* to an inflammation of the cord, or may be of a *primary* and apparently *idiopathic* origin—a degeneration of the cord.

The symptomatology of this disease presents a wide range, in accordance with the varying extent and sites of the foci of softening that may exist in different patients. In a case of complete softening of the cord the symptoms would correspond to those of transverse myelitis; in another of incomplete softening the symptoms would in the main correspond to those of compression of the cord from tumors, Pott's disease, etc. To arrive at a diagnosis is often extremely difficult; as it is only by studying the history of the case and by exclusion that we can do so.

Acute Anterior Polio-Myelitis.

(*Acute Atrophic Paralysis, Infantile Spinal Paralysis, Essential Paralysis of Children.*)

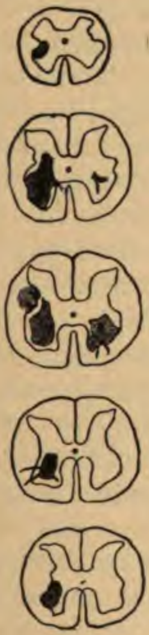
This affection consists of an inflammation and destruction of the gray matter (motor and trophic cells) of the anterior horns of the spinal cord; and, as a consequence of the destruct the cells (motor and trophic), there is paralysis of motic atrophy of the muscles supplied by the nerves which from these cells.

Ætiology.—It occurs more frequently in children tl adults, and is met with more frequently in summer tl winter. The most frequent causes are exposure to cold, s on damp grass, overexertion, and injuries. In some cases seems to be no attributable cause.

Symptoms.—The characteristics of this affection are s tinct and well defined as to make it, in the majority of the easiest of all the diseases of the spinal cord to diag It is a disease in which voluntary power is lost in the cou a few hours or days, and in which some of the para muscles undergo rapid wasting, while others recover. It m ushered in with a convulsion, or it may begin with a chil lowed by fever, headache, prostration, loss of appetite, and lessness. *Nausea* and *vomiting* are common symptoms on account of this, in many cases the illness is attribut stomach troubles. These constitutional symptoms may from a few hours to a few days, and as the fever subsides a alysis rapidly develops. In some instances a child seen and feverish when put to bed, and in the morning is fou be paralyzed. This paralysis may affect both arms and legs, the legs alone, or possibly only one of the four extren It may begin in one leg and in a few hours or days invol the limbs.

The legs are affected more frequently than the arms, an left leg more frequently than the right. (Gowers.)

It may occasionally be a hemiplegia. The sphincters, rule, are not involved, although the bladder may be tempo affected at the onset of the disease. Sensation, as a ru not affected, and there is no tendency to the developme bed-sores. The temperature of the affected limb is lower than that of the corresponding sound one. The ref are abolished. One peculiar feature of this disease is tha paralysis is greater than the real. At the onset of ase all the voluntary muscles of a limb or of the ay be paralyzed, and in a few days (two or three)



—TRANSVERSE SECTIONS OF THE CORD SHOWING LOCALIZATION OF THE ANTERIOR HORNS OF THE GRAY MATTER OF THE SPINAL CORD. ger, after Roth.)

a spontaneous recession of the paralysis from most of scles, leaving only certain groups affected. This is ed for by the fact that at first the inflammatory and the attending hyperæmia press upon the ar cells which supply an entire limb, thus temporarily ng with the function of a large number of cells, but not ng them; then, as time goes on, the pressure is relieved cells by the absorption of the exudates and the lessen- e hyperæmia, and they recover their function, and the muscular fibers which were connected with these cells re their function, and thus parts that were paralyzed durin acute attack of inflammation eventually recover their po while only those muscles remain paralyzed whose gover cells were completely destroyed.

After the paralysis has reached its height, which varies a few hours to a few days, there is a stationary stage at w the disease remains at a standstill, varying from a few da six weeks; then comes the stage of regression (improvem which requires from one to three months. The improve beginning in the part last affected.

As the paralysis begins to recede atrophy sets in, the mu of the paralyzed limbs waste rapidly, and this wastin markedly progressive. This is especially manifested when upper extremity is the affected part; as regards the shou the head of the humerus sometimes falls away from the gle cavity to the extent of an inch or more. As the paral muscles waste away, contractions take place in certain paralyzed muscles (antagonistic muscles), which cause var deformities, such as club-foot, etc. The bones are also su to atrophy and to arrest of growth, so that the paralyzed atrophied limb remains ever afterward shorter than the co sponding sound one.

Diagnosis.—The characteristic symptoms of anterior po myelitis are: A sudden and more or less extensive motor alysis, which is followed by a rapid and extensive atrophy; absence of cerebral, sensory, vesical, or rectal symptoms, ex temporarily at the onset; the tendency to improve; the elec cal reaction. If the faradic current is applied to the parts. paralyzed muscles will *fail* to respond; but when the galva current is used, a slow contraction takes place—*the reaction degeneration.* In no other disease is the electric excitabi so thoroughly abolished as in *acute polio-myelitis.*

There are four stages in the course of this disease, nam

1. A stage of invasion, or the initial stage of paralysis, va ing from a few hours to a week or even more.

stationary period, which lasts from one to six weeks.

stage of improvement, during which the paralysis away from all the muscles which have not undergone ; this period lasts from six months to a year.

chronic stage, which is of indefinite duration, improve- ontinuing in a slight degree for years.

nosis.—The patient rarely dies from the disease unless hould occur during the first stage. Deformity to a r less extent is the rule. Even in the slightest cases, e recovery is extremely rare, the limb always remain- aller than its fellow. Where wasting occurs, wasting , so that the palsy scarcely ever passes away entirely; instances the improvement may be so complete that it y perceptible.

tment.—The object of the treatment should be to arrest er and control the reflex disturbances; to arrest or the morbid processes in the cells of the anterior horns, er to improve the degenerated nerve and muscle. In te stage the child should be put to bed and kept there; ng an important adjunct.

ite.—Aconite is especially called for when the affection o exposure to cold and dampness. The child is restless, , thirsty; face pale and an expression of anxiety; or , fiery redness of face; face red and pale alternately; dry heat of body, yet chilly at the same time; excessive yet can retain nothing; twitching of the facial muscles; ss of small of back extending into the lower limbs; s of the feet and ankles; child screams aloud at the t touch, screams with pain.

donna.—Belladonna usually follows aconite. There is ction, with congestion to the head; face flushed; pupils delirium; twitching of certain groups of muscles, or eneral convulsions; paralysis of the lower extremities; the bladder and sphincter ani.

ricum.—Especially adapted to mechanical injuries of d, and the nerves at their peripheral extremities; constant drowsiness; pupils dilated; face puffed and ho thirst; desire especially for warm drinks; tongue coate the slightest motion of the arms or of the neck exto the vertebræ over the seat of the lesion very sensitive t

Gelsemium.—Cerebro-spinal symptoms, such as con the head, extending from the occiput to the forehead; ance of vision; pain in the back of the head and spi radiating from spine down the limbs; loss of voluntary incontinence of urine.

Causticum.—Lancinating pains in the back, arres breathing; numbness and insensibility of the fingers a with ice-cold sensation and tendency to cramp.

Cocculus.—Tonic and clonic spasms; extreme exh great chilliness, cannot get warm; sensation of worms over the parts; persistent nausea, sometimes accompa vomiting.

Oxalic acid.—Limbs stiff, numb, weak, heavy, po muscular twitching; acute pain in the back, with n and weakness, extending to the limbs; pains exci aggravated by movement; they are usually like short confined to a small spot and lasting only a few seconds.

Secale cor.—Violent pains in the back, especially sacral region; muscular twitching and jerking of the lim ling in the back, extending to the fingers and toes; pai tractions of the flexor muscles; paralysis and anæsthesi limbs; especially indicated in cases complicated wit meningitis.

Verat. alb.—Aching and sticking pains in the back; in the hands; painful jerking in the limbs; cramps in th paresis.

Mercurius.—Paralysis of the lower extremities; als bladder and sphincter ani; with tendency to twitch shocks; severe spinal pains, worse from pressure; sud and stiffness of nape of neck, and of upper an extremities; child lies motionless in bed; face shrunke in color; sensation of coldness with tremors, though shed temperature; symptoms all aggravated at night in iild becoming restless and sleepless.

s. tox.—Where the disease is the result of getting wet; s high fever, great restlessness, tingling sensation in the ollowed by complete paralysis.

nbum.—Chronic cases where the paralyzed part soon away; where the limbs become painfully contracted, here there are frequent spells of colic with retraction of domen.

ctrical Treatment.—There can be no doubt as to the cial effects of electricity in this affection, for it is an ion for a muscle to be so completely destroyed by polio- is as to have no functional fibers left; so that by persist- mulation great development of the remaining fibers may ned. Even where the electrical reactions are entirely ied, some improvement may still be hoped for; although, le, where there is early and complete loss to excitability idism, the wasting and paralysis will be permanent.

electrical treatment may be begun as soon as the natory process begins to subside—fourteen to sixteen As a rule, the treatment should be begun with the limbs, a mild galvanic current. The negative pole (labile) be applied to the affected limb; the positive, applied to ndifferent part of the body—for instance, the sternum. ı a few days the central lesion (spinal lesion) should be l; the negative pole being placed over the seat of the the positive over some indifferent part of the body. The ient should be given two or three times a week. By ieans we may hope to aid the regeneration of the ied neuro-muscular elements, and to avert the degenera- others which may have been less severely injured. Dur- second and third stages the interrupted galvanic current ive to the extremities) is of great service and will usually of more benefit than any other form of electricity. In the c stage, where the active processes in cord, nerves, and s have subsided, and the object being to stimulate the muscular fibers, the faradic current will be preferable duration of the electrical treatment will be long, varyin three to six or even twelve months, and it will requir perseverance on the part of the physician and the p friends to keep it up; yet the ultimate benefit obtained overbalance all trouble and expense attached to the trea

Rubbing or massage may be advantageously combine the electrical treatment.

Surgical Treatment.—The deformity in these cases either to a contracted fascia, or to contraction of some muscle or muscles acting in opposition to the paralyze In regard to the correction of these deformities by s measures, Dr. Wm. H. King (*Medical Century*, July, 189 " If the fascia is contracted to a great degree, it will hav cut; for it will be found impossible to develop a sufficiently to overcome the contracted fascia. With tracted muscle it depends upon the degree of shorteni the contraction be slight, so that the deformity can be r by slight pressure, a properly fitted brace may be supp support the paralyzed muscles and keep the deformity r If, however, the contraction is so great that this can done, tenotomy will have to be performed. I am gr favor of a patient wearing a brace to take the strai muscle, even if the deformity is not marked. I am positi they improve faster than when they are not support course, after they get sufficient strength to support the and keep down the deformity, the brace should be ren

Spinal Paralysis of Adults.

This is a peculiar form of paralysis in the adult, r from inflammation and degeneration of the gray matte anterior horns of the spinal cord, and followed by more atrophy of the paralyzed muscles. Cold is a prominen in its causation, although in the majority of cases no c be ascertained. The paralysis may begin in one or bot extremities and progressively advance upward till the ıities are affected; or the superior extremities may be ed first, and subsequently the inferior. Generally, how- he onset is sudden, resulting in complete paralysis of all ıbs, and as the paralysis retrocedes atrophy sets in. In of the cases the beginning of the disease is characterized ere pains in the back, which radiate into the limbs; but he initial stage of the affection, these gradually pass away. is very little interference with the sensory functions; in ıjority of cases none at all. The bladder and the sphinc- i generally remain unaffected. The facial muscles are ever involved. There are no bed-sores. The reflexes ·ly diminished and later abolished. The electrical irrita- of the faradic current is lost early in the disease; but it is ıowever, that the excitability to the galvanic current is y abolished.

re is usually very little deformity, as the bones of the are fully developed; and in consequence of the adult's r energy of will impelling him to bring into action ·s which can be made to perform the duties of the par- ones, as well as in consequence of the greater firmness sisting power of the ligaments of the adult, secondary ıities from contracture are not developed to the same : as in the spinal paralysis of children. (Meyer, of .)

:he majority of cases the paralyzed parts, after a period g from two or three weeks to several months, begin to ·r their power, but rarely is there complete recovery.

gnosis.—Spinal paralysis of adults, like spinal paralysis ınts, is to be diagnosed by the facts that in the beginning ıralysis is extensive; that soon there is a stage or regres- ollowed by atrophy; that the paralysis always precedes :rophy; that the sensory, rectal, and vesical functions are ightly interfered with if at all; that there are no bed-sores; :here is loss of the faradic irritability; and that there › cerebral symptoms.

›gnosis.—Progŋosis is good, as regards the life of the patient, unless it affects the respiratory centers. In cases recovery may be complete, but, as a rule, there is or less loss of voluntary power with atrophy and deformit

DEGENERATIVE DISEASES OF THE SPINAL CO

Under the class of diseases that are considered of a dege tive nature would come such affections as locomotor at progressive muscular atrophy, etc. These diseases at certain columns or parts having a definite physiological pose. Chief among these degenerative diseases stands *motor ataxia*.

Locomotor Ataxia.

(*Tabes Dorsalis, Posterior Spinal Sclerosis.*)

Locomotor ataxia is a chronic, progressive disease of spinal cord and peripheral nerves, characterized by inco-or tion, peculiar lightning-like pains, anæsthesia, and var visceral and trophic symptoms.

Ætiology.—It occurs most frequently between the age twenty and fifty; rarely does it occur either before or after t periods. It is more common in males than in females. occurs more frequently in large cities than in the coun Syphilis heads the list as a cause of ataxia. It is estim that eighty-seven per cent. of the cases are due to this affect It may be the result of inherited syphilis, but more freque it is a degenerative sequel of syphilis, rather than a true sy litic disease. Locomotor ataxia in a child may always ascribed to syphilis. Other causes are injuries to the sp concussion of the spine; exposure to cold; sexual exc acute blood diseases; heredity. Excessive use of alcoh liquors has been given as the cause of this disease.

Symptoms.—The disease is essentially of a chronic nat although acute cases do occasionally occur, running their co in a few months. It may extend over a period of from te twenty years before the symptoms become fully develop

It has no uniform set of initial symptoms. Sometime with a dull, heavy pain in the small of the back or other f the spinal column, which is soon followed by peculiar described as stabbing, fulgurant, or lightning-like pains, occur chiefly in the lower limbs, but may occur in any part of the body. The stabbing pain is described as feel- e a knife plunged into the limb and twisted around. The ant pain is, as the name indicates, a pain somewhat bling an electric shock passing through the limbs. re are few kinds of pain which equal, and none which sur- severity, the pain which accompanies certain forms and of locomotor ataxia. This pain is short, sharp, and , coming with lightning-like shocks.

se spontaneous pains are present in some degree in the majority of cases of tabes. They are usually parox- and are apt to come on at night. They may continue few moments only or for an hour, or even a day varying in seat, but often felt in the same part hout an attack or through many attacks. They rom neuralgia in that they do not follow the course dividual nerve-trunks, but are usually confined to scribed areas, which are between the joints, never in After the attack of pain has subsided, the skin over the pain is extremely sensitive to touch; " as sore as a boil " xpression which these patients often use in describing If the pain has continued for several days at one spot, r and trophic changes may occur.

er kinds of severe pain, less brief than the lightning pains, n some cases, and are described as " burning," " tearing," gnawing " pains. (Gowers.)

e early stages of tabes there may be a dull pain, which is ated (as any of the pains of tabes may be) by damp, cold r, thus causing the mistaken diagnosis of rheumatism or gia to be made. Visceral pains may also occur, usually smal and referred to the stomach, bladder, rectum, etc., ting for hours and simulating organic diseases. There anæsthesia of the skin to the sense of touch, pain, or

temperature. The loss of sensibility gives rise to some cu
sensations, especially in the soles of the feet. There ma
sensations of " pins and needles " and other forms of numb
a feeling as if the feet were cold or numb; as if sand were i
shoes; as if cushions or some soft substance were on the so
the feet; sometimes there are burning pains in the soles o
feet. These various pains and sensations may precede the
symptoms (lightning-like pains, ataxia, etc.) by month
even years.

Another symptom peculiar to this disease is a delay i
perception of pain which may amount to several seconds (
a few to fifteen seconds, according to Eulenberg); that is
transmission of sensitive impressions (for instance, the pri
a pin) to the brain does not take place with the normal de
of activity. The contact of the point may be felt at once
pain only after a considerable interval. Gowers says that
there is an after-pain, lasting sometimes for a quarter or
minute or longer, and that the maximum sensations may n
attained until some seconds after the pain is first felt. Atr
of the optic nerve is generally an early symptom of tabe
gradually progresses, and in most cases ends in total blind
In other cases, however, it may cease to progress, and
undergo slight improvement. Deafness, having the chara
of nerve-deafness, is met with in some cases, sudden or gra
in onset, transient or lasting. Loss of sexual power is exc
ingly common, and often an early symptom of the disease,
may precede any impairment of sensory or reflex funct
Loss of tendon reflexes, especially of the knee-jerk, i
early symptom of tabes. The sphincters of the bladder
rectum may be involved early in the disease, causing slug
micturition and a tendency to incontinence both of the u
and fæces. This paresis of the sphincters never progress
the stage of paralysis.

When the disease involves the cilio-spinal center it ca
loss of the reflex action of the iris to light—that is,
pupils will not respond to light, but will to accommodat

dition is known as the Argyll-Robertson pupil. The
re often not perfectly circular, and are frequently
in size. In some cases the pupils are contracted to such
as to suggest morphinism; while in others they are but
affected. There may be diplopia, due to paresis of the
of the eyeball—usually of a temporary character—with
out slight ptosis. In a very large number of patients
from locomotor ataxia there is a history of diplopia,
us, or ptosis having preceded the lightning-like and
t pains and the ataxia, and disappearing before these
ms become well marked; again, in other cases, they do
e their appearance, if ever they do, until the later stages
ffection.

esia of the ulnar nerve is a characteristic sign of tabes.
betics experience no pain from violent compression of
r nerve, although the characteristic tingling sensation
the fingers. Dana calls attention to a symptom that is
ristic of tabes—namely, a sense of great weariness and
ss in the limbs, present constantly, no matter how much
ken; this is due to an irritability of the nerves of muscu-
ibility. Constipation is an annoying complication in
ses. The sense of taste and smell are rarely affected.

e second stage of the disease "ataxia," or inco-ordina-
the voluntary muscles, is developed; although in a few
makes its appearance in the first stage of the disease.
ia there is difficulty of standing or walking with the
sed. Such patients keep their eyes upon their feet or
he ground just in front of them while walking. The
comes less steady and regular; the legs are thrown wide
o as to increase the basis of support. There is inability
d with the feet close together when the eyes are covered.
tient is unable to walk on a straight line, as a chalk-mark
ck in the floor. In walking the feet are raised too high
own forward too far, the heel striking the ground first,
e following at a considerable interval with an abrupt
g motion. The legs are moved about in a more or less

spasmodic manner, sometimes crossing one another while
ing. Soon the patient is obliged to use a cane or two
for support to keep himself from falling.

When the upper extremities are involved, it is difficu
even impossible in some cases, for the patient to pick up

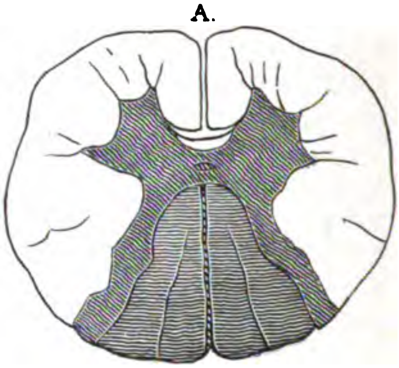


FIG. 54.—SHOWING A SECTION OF THE SPINAL CORD FROM A CASE OF
MOTOR ATAXIA. *A*, total sclerosis of the posterior columns of Goll and Burda

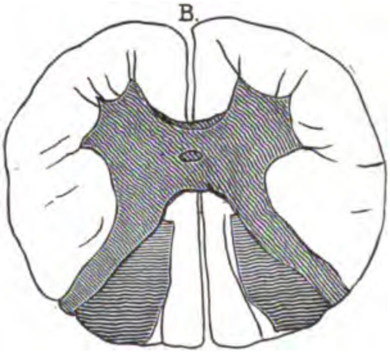


FIG. 55.—*B*, sclerosis of Burdach's columns, the columns of Goll not being implicated.

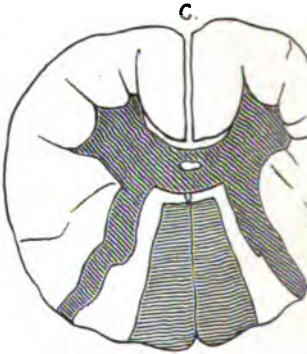


FIG. 56.—*C*, sclerosis limited t
columns of Goll.

from a smooth surface; or, again, when such patients are as
to place the tip of the finger on any designated spot on
face (provided the eyes are closed), they utterly fail to perfo
the act, often touching a spot one or two inches from that up
which they intend to place the finger. As the disease p

t becomes impossible for the patient to button his coat, ntually the ataxia may render the patient absolutely unable to rise without help, to stand alone, or even to out support. Usually the motor strength is in marked to the helplessness of the ataxia. Motor weakness is nvariably the last of all symptoms, and in some cases ower remains in the limbs unimpaired to the end.

al symptoms rarely ever occur in locomotor ataxia, h occasionally, when the morbid process reaches the ta, mental symptoms develop which are strikingly like *paretic dementia*, and imitate both the "melancholic" aniacal" types of that disease. (Spitzka.)

e later stages of the disease the muscles may undergo . The joints may become implicated; first an accumu- f water in the synovial cavity, and a general œdema soft parts; later, atrophy of the bone substance, thus g in spontaneous fractures and luxations.

ology.—Locomotor ataxia consists of a degeneration of ve-elements (a gradual decay and death of the nerve- d cell), followed by an overgrowth of connective tissue, g in sclerosis (hardening) of the posterior columns of al cord; also of the posterior nerve-root, and frequently ipheral nerves. The columns of Burdach are affected equently than the columns of Goll. The direct cere- ract and the column of Gowers are also affected. The dal tracts are only involved in complicated cases. The r roots are never involved. The disease usually begins umbar or dorsal region and extends upward; but it may n the upper part of the cord first, and then travel down- The ultimate cause of the degenerative process is not but in all probability it is a toxic influence, constantly which sets up a progressive destructive process, and has a selective influence on certain tracts in the posterior s, with their roots and ganglia.*

---

pathogenesis of tabes is still uncertain. Syphilis is looked upon as an and frequent cause. Most authorities agree that the disease begins pri- the nerve-roots, from an invasion of vascular supply, either from an arterio-

Diagnosis.—In the early stages the diagnosis is somet
extremely difficult; but in the advanced stages is easily r
The diagnostic symptoms are:

1. The stabbing and fulgurant or lightning pains.
2. Absence of the tendon reflexes (knee-jerk principall
3. Ataxia or inco-ordination, without much loss of mus
power.
4. Anæsthesia, especially of the soles of the feet.
5. Argyll-Robertson pupil.
6. Primary atrophy of the optic nerve.
7. The visceral crises.
8. The history of syphilis and the slow onset of the dis

There may be said to be three cardinal symptoms, *on*
which *must* be present in order to make a diagnosis of loco
tor ataxia—namely: *the peculiar pains, the peculiar ataxia*
an absent knee-jerk. Upon no one of these alone can a diag
sis be made, but any one of the three associated with o
pathognomonic symptoms may make the diagnosis certain.

Prognosis.—In the first stage the disease may be checl
and in many cases improved. In the second stage, the st
of ataxia, there is a possibility of checking the disease and ca
ing it to become stationary, and in some cases there may b
slight improvement, the patient made relatively comforta
for years; other cases, however, steadily progress from

sclerosis or a meningitis subsequently followed by a sclerosis of the connective ti
of the cord. There has also been found a twisting with degeneration of poste
nerve-roots, probably due primarily to meningitis, with compression and subseq
degeneration. Professor Obersteiner gave the results of some researches upon
subject which he had undertaken with Dr. Redlich. From sections of the cord at
level of the posterior roots, they had found that there was a twisting of the latte
their point of entrance into the cord. This strangulation must be an important fa
in the pathogenesis of tabes, which, Professor Obersteiner believed, had its prin
origin in a meningitis, causing compression of the posterior roots, soon followed
their degeneration. This theory is in accord with the clinical picture of tabes,
with the relation of syphilis to that disease, since syphilis tends to produce scler
of the connective tissue and vascular lesions, these latter, with the proliferations
pachymeningitis, being the cause of the compression. Naturally, all diseases wh
lead to meningeal lesions and arterio-sclerosis may also determine tabes, and all ca
of the disease should therefore not be attributed to syphilis.

ng to the end. In the last stage, the paralytic stage,
can be hoped for is to ameliorate the symptoms and
he patient comfortable. Death usually occurs from
tercurrent malady, or from kidney disease caused by the
trouble. Facial palsy ensuing in the course of loco-
taxia is generally an unfavorable sign, as it shows that
ase is gradually advancing toward the medulla ob-
and the roots and nuclei of the cerebral nerves.

tment.—The object of treatment should be the arrest
isease and the palliation of the symptoms. Rest, physi-
mental, is of primary importance; absolute rest for a few
r months is always of value, and in many cases is alone
t to cause a long arrest of the disease. Excessive men-
k, the use of alcoholic stimulants, and sexual excesses
be prohibited. Exposure to cold and dampness should
ded. The removal of all possible sources of reflex or
ritation is a point that must not be overlooked. A sea
or a trip to the mountains or to some mineral springs
s beneficial, as it secures rest and tones up the general
In all cases inquiry should be made with reference to
stence of a syphilitic taint. If the disease occurs in
ion with general syphilis of the nervous system or as the
f inherited syphilis, anti-syphilitic treatment with such
s as kali iod., mercurius, nitric acid, etc., will prove bene-
hile, on the other hand, if it is the sequel of a syphilitic
ration, this line of treatment will have no influence
er upon the disease, and in many cases will be a positive
especially the use of mercury.

cot speaks very highly of the treatment by suspension.*
pecially useful in the ataxic stage and where there are
troubles and pain. In this procedure the patient is
led by the neck and arms, a strap passing under the chin
under each arm. The ligaments of the spinal column
posed to be so stretched that the spinal cord and its
oots are elongated. The suspension at first is only of

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* The apparatus of Dr. Sayre of New York is one of the best.

half a minute duration; this is gradually increased to tl
minutes, the maximum not exceeding four minutes. A tr
ment should be given every other or every third day u
twenty-five or thirty have been taken. After three mon
a second course may be given.

Electricity.—In electricity we have a most efficient reme
in fact, no other therapeutic measure equals in any degree
scientific use of electricity in the treatment of this affecti
Certain it is that in electricity we possess an invaluable the
peutic resource in the treatment of locomotor ataxia, and
especial use is electricity in the initial and ataxic stage.
many cases the pains and ataxia have been caused to disappe
and the patient to resume a life of comfort and comparat
activity.

Galvanization has long held the foremost place in the tre
ment of tabes. The method of applying the electrodes m
vary; one electrode (positive pole) may be placed at the nape
the neck and the other (negative pole) in the lumbar region.
one may be fixed and the other moved up and down the spi
or the positive electrode may be fixed upon the spine (
electrode 1½ inch wide by 18 inches long); while t
negative pole may be placed upon the sternum and mov
over the nerves of the extremities. (In all degenerative lesio
of the cord the positive pole should be applied over the seat
the lesion—the negative to some indifferent part of the bod

To affect the cord indirectly or reflexly, Rumpf advises pla
ing the faradic anode upon the sternum, while the cathode
applied to the skin of the back and of the lower extremiti
until a decided rubefacient effect is established. He clai
that the treatment applied in this manner stimulates the senso
nerves of the skin, which reflexly affects the circulation a
nutrition of the cord favorably. Rumpf's treatment with tl
electric brush, by means of the rapidly interrupted farad
current, has proved beneficial in relieving the pains and tl
ataxia.

In static electricity we have an agent that surpass

the galvanic or the faradic currents. The patient should
ced upon the insulated platform and heavy sparks (posi-
pplied up and down the spine; also the cutaneous periph-
rve-distribution may be excited by means of a fine spark
ced by means of the spray or the massage roller.

ic electricity will do more to relieve pain and maintain
ee of comfort than any other agent. By means of this
ent the swaying symptoms, the ataxia, and the bladder
xual troubles may be made to completely disappear and
it to become normal.* Used in conjunction with gal-
, it may arrest the progress of early cases indefinitely.
tment of the nerve-roots and the peripheral nerves
not be neglected, since they, as well as the posterior
ns, are in many instances the seat of pathological changes.
best accomplished by applying the faradic current or
rks to the back, and especially to the extremities.

icial Measures —Orificial work ranks next to electricity
treatment of tabes. If there are any pathological con-
at the orifices (stricture of urethra, piles, redundant
nucous membrane), they should be treated according to
thods described in any work on *orificial philosophy*, and
rd a course of dilatation employed, either by means of
alvular speculum (without the use of an anæsthetic) or
tal plugs. By means of this treatment the circulation is
ed, the capillaries are flushed, nutritional energy is revived
ord, the degenerating cells take on new life, and the dis-
the majority of cases is checked and improved. The fre-

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e value of static electricity in the treatment of locomotor ataxia, Professor
"International System of Electro-Therapeutics") says: "A case of loco-
xia cannot be said, in the opinion of the writer, to have had the full benefit
lectricity can accomplish until it has been treated by the franklinic current.
eans I have seen the swaying symptom, the ataxia, the pain, the anæsthetic
bladder and sexual troubles completely disappear, the field of vision to
large, and the gait to become normal. I have never known the knee-jerk
nor have I ever seen what I should regard as a complete cure. But I have
plete arrest of the disease, lasting for years—and this, too, in the second or
age. Although a complete cure cannot be promised, nevertheless the
an be relieved from their distressing pains, and in many instances restored
natural gait."

quency of the treatment will vary according as to whethe rectal plugs or the bivalve is used; the rectal plugs may be once or twice a week; the bivalve should not be used oft than from ten to fourteen days.

There is a form of treatment, termed the *mechanical* t ment of Frënkel (as given by the New York *Therap Review,* 1895). This treatment tends to correct the salient symptoms of the motor troubles: Ataxia, at firs augmenting the strength of the muscles in the affected li then by masking in a measure with appropriate muscular e cises the lack of co-ordination in the movements.

The principle of Frënkel's treatment consists in making patient execute movements more or less complicated, but reasoned manner, and with care. In principle, Dr. Frë notes three categories of movements:

1. Simple muscular contraction; that is, of a single muscl of a physiologic series of muscles (flexion, extension, adduct abduction, etc.).

2. Simple co-ordinate movements (taking an object determined distance, touching the end of the nose with forefinger, taking the hand to the mouth, etc.).

3. Compound co-ordinate movements (writing, tal objects at distances successively different, taking a spoon to mouth, etc.).

Dr. Hirschberg, treating by this method, proceeds in following manner:

1. The patient lies down with bare legs, and makes, at with one foot, now with the other foot, and then with b feet, simultaneously, flexions, extensions, abductions, adductions.

2. Flexions of the knee in the same order; at first one kn now the other knee, then both knees simultaneously.

3. Flexion, extension, adduction, and abduction of the h in the same order as above.

Besides these movements, there are more complicated mo ments, such as having the patient stand without a stick.

art, his hands at his hips, and while in this position bend
ly forward at the left, backward at the right, at the same
escribing a circle with his head; or again, having the
walk with the aid of a stick, on a straight line traced on
or, etc. Every movement is repeated until the patient
ls in predominating over this muscular contraction.

y treatment should last half an hour, or even longer, and
owed by massage of the legs. This massage rids the
muscles of the products of fatigue and enlivens their
on. After a few sessions it will be found that the patient
ve better control over the movements of his limbs than
the treatment began.

cupping, or what is often known as the vacuum treat-
has accomplished much benefit when followed out with
ghness. The cups should be left on from ten to fifteen
s, the air being kept well exhausted all the time; the
spine should be cupped. This treatment should be
twice or three times a week for about three months,
llow an intermission of the same period, and then re-
he treatment again for about the same length of time.
e-vibration will prove beneficial in many cases. In
g of this method of treatment for locomotor ataxia, Dr.
Delamater (*Journal of Orificial Surgery*, May, 1895) says:
e-vibration has probably been productive of more possi-
ults than any other one line of treatment. It, however,
s patience and great attention to detail. It must be
aily at as near the same time of day as may be, and in
ne order from point to point, and for the same length of
n each point. In using this treatment, always keep in
hat the object to be accomplished is perfect regularity
hm, and that cannot be done by irregular procedures.
ence at the toes; take in order the tendons near the sur-
hen the sole of the foot; then over nerve-trunks just
each malleolus; then up along and over all the surface
tibia, searching for particularly sensitive spots and stop-
n them; then at each point on each leg where a nerve-

trunk is near enough to the surface to be directly affecte usually continue this in conjunction with the cupping or ing for six months at a time, with an intermission of abou months. After the first year, I commence to apply the ha over the spinal processes, commencing at the lowest and ing each one in succession to the top. I usually apply it to point one-half or one full minute."

Plumbum.—Plumbum is a remedy called for in the first st It is indicated where the pains come in paroxysms, so severe he cries out; the pains are greatly aggravated at night; there is disturbance of vision (amaurosis) from atrophy o optic nerve; difficulty in passing the urine; the passing o urine sluggish, and a tendency to incontinence; unable to it, apparently for want of sensation to do so (paresis). are "shaky" when he attempts to use them; tremor of the preceded by weakness and numbness; tongue trembles being protruded or when he tries to articulate; speech d ging and slow. This remedy produces the anatomical les of disseminated sclerosis, the tremors, the paralysis, and muscular atrophies, and it has repeatedly cured t symptoms.

Aurum mur.—Fulgurant pains, ataxia, weakness, paresi lower extremities, double vision, blur before the eyes.

Aluminum.—Pains in the soles of the feet; a sensation if they were swollen, or a sensation as if walking upon so thing soft; inability to walk with the eyes closed; numbnes the heels when stepping upon them. Arms and legs feel hea pain in the back as if a hot iron was thrust down the lo vertebræ.

Strychnia.—Staggering walk; numbness of the feet; par of the bladder.

Argentum nit.—Vertigo, tendency to fall sideways; stagg ing when walking in the dark; drawing, heavy pains in limbs; loss of sexual desire; anæsthesia of legs and feet.

Belladonna.—Ataxia, loss of power to co-ordinate musc movements; weakness of lower limbs and tottering gait; wh ng he raises his legs as if he had to pass over an obstacle; ses the feet slowly and puts them down with force.

ıs tox.—Loss of power of co-ordination in lower ex- ies; staggers, takes longer steps than he intends, steps r than usual. Symptoms worse in cold, wet weather, in nd at rest.

gustura.—This is especially useful in the first stage for lgurant and lightning pains.

ısphorus.—This remedy is indicated in every stage of the aint. The fulgurant pains and visual disturbances of rst, the ataxic symptoms of the second, the paralytic, rophic, and degenerative condition of the last.

senicum.—Cold feeling in the soles of the feet; soles feel made of wood and do not feel the ground; heaviness of nbs; painful feeling of fatigue, penetrating to the marrow bones; twitching, trembling, violent starting while fall- sleep; tearing pain in the tibia; frequent cramps in the of the legs; stiffness in the spinal column, beginning in acral region; bruised pain in the small of the back, with ion of weakness; formication along the spine; burning in oine.

nnabis indica.—Dimness of vision; oppression of chest, deep labored breathing, worse when ascending; pain s the shoulders and spine; pain with drawing through the ar vertebræ, on standing; weariness in both legs, almost nting to paralysis; stiffness and tired aching in both ; numb feeling and pricking sensation in soles of feet.

usticum.—Eyes become dim, and vision indistinct; it s as if a thick cloud or fog were before the eyes; diplopia nability to turn the eyes outward; sensation of heaviness e upper eyelids (threatened ptosis); painful stiffness of ack and sacrum, especially when rising from a chair; tear- beating, boring pains in the lower legs and feet; nightly ing, tearing in the shins from above downward; cramps e calves of the legs, worse at night; numbness of feet and

Nux vom.—Retention of urine; urine discharges dro
drop; difficult urination with pressure and tenderness i
region of the bladder; sexual impotence; burning, te
drawing, lacerating, or bruised pains in the back; sensati
loss of power in the lower extremities; when walking,
tremble; unsteady gait (ataxic gait); drags the feet; tott
and unsteadiness of the lower extremities; staggering
walking; numbness and deadness of the legs; cannot
without support of cane; makes a few steps with diffic
dragging feet after him; pains like electric shocks pa
through the limbs; tearing pains by paroxysms.

Before beginning the treatment of a case of locomotor a
impress on the patient the fact that it will require the gr
part of a year, in the greater majority of cases, before impr
ment is decidedly marked, and that it will require from tw
three years or even longer in some cases to establish a
even when a cure is possible.

Much that has been said in regard to the treatment of l
motor ataxia applies also to all of those spinal diseases, suc
primary spastic paraplegia, ataxia paraplegia, hereditary at
etc., that are of a degenerative type.

Hereditary Ataxia.

(*Friedrich's Disease, Family Ataxia*).

This disease is due to degeneration and sclerosis of the
terior columns and the lateral pyramidal tracts of the sp
cord. It is characterized by ataxia beginning in the lo
limbs and gradually involving the upper limbs and the org
of speech.

The lesion begins in the lumbar region and extends upw
and downward, finally involving the medulla, and especi
the nuclei of the hypoglossal nerve. (Dana.)

This is a disease confined mostly to early childhood.
occurs more frequently in males than in females.

It is not an hereditary disease in the strict sense of the te

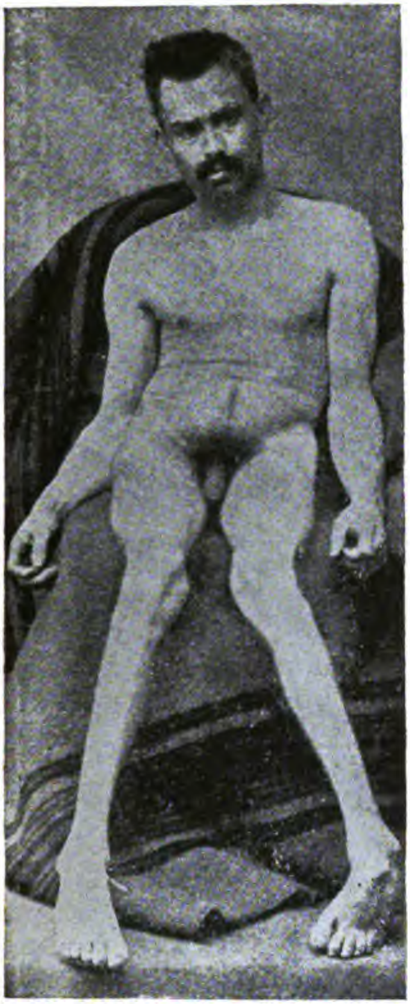


FIG. 57.—FRIEDRICHS' ATAXIA. Late stage, showing curvature of trunk and formity of legs. (After Dana.)

ut rather a family disease, showing itself in several children of ie same parents, although neither they nor their parents may ave had the disease. (Bastian.)

In the majority of cases, however, the history shows that the ncestors suffered from some neuroses, such as insanity, epilepsy, neuralgia, nervous irritability, etc. Syphilis or al holism in the parents is also a predisposing cause.

The chief symptom is *ataxia* (inco-ordination), which sh first in the lower extremities and is manifested by unsteadi in standing and walking. As the disease advances the have to be placed wide apart in standing, and when the c attempts to walk, it is not unlike that of a drunken man. slow degrees the weakness increases till even standing beco impossible; soon the trunk and head become the seat of os lations, which are aggravated when the patient moves, but ce when he is completely at rest in the recumbent position.

There is very little impairment of the sensory functions; some cases there may be anæsthesia of the legs, but rarely e do they have the stabbing, fulgurant pains of locomotor ata There is an absence of the knee-jerk; no impairment of sphincters and no tendency to trophic changes in the skin joints; no atrophy of the optic nerve and no visceral distu ances. The tendency of the disease is to travel upward, invo ing the trunk and upper extremities, and at last involving organs of speech. Nystagmus is a common symptom. the disease advances there is a slight atrophy and paresis the muscles; rarely, however, does it amount to absol paralysis. In the later stages of the disease spinal curvatu (usually the lateral) develops; also many have talipes equino equino varus of the feet.

There is no mental change that can be regarded as a part the disease, although imbecility has coexisted. (Powers.)

The disease slowly progresses to a fatal termination, but y it may continue for years before proving fatal. Treatme avails very little. The measures recommended for *locomot* *ataxia* are the most suitable to the hereditary form.

Primary Lateral Sclerosis.

(*Spastic Paraplegia.*)

This affection is due to a lesion of the motor fibers in th lateral columns of the spinal cord. It is called *primary* later sclerosis in contradistinction to another affection (*secondary* lateral sclerosis), which is due to a lesion involving some portion of the brain structure, followed by a secondary degeneration (*descending sclerosis*) of the motor fibers (*crossed pyramidal tracts and the columns of Türck*) of the cord.

In the main the symptoms are the same, whether the disease is in the cortex of the brain, the internal capsule, the pyramids of the medulla, or the pyramidal tracts of the cord; the main difference being that a lesion confined to one lateral half of the cord causes a pronounced type of paralysis below the point of lesion, the paralysis being on the same side as the lesion; while from a lesion in the brain the parts are paralyzed to a less degree, because the leg is enervated from both cerebral hemispheres.

When the lesion is in the brain, there is usually a history of an involvement of some of the cranial nerves. In case the lesion is bilateral, whether in the brain or cord, the symptoms are identical. In primary lateral sclerosis the lesion generally involves both sides of the cord.

The cause of this affection in many cases is obscure. It is a disease confined chiefly to the middle period of life. It affects both sexes with equal frequency. In some cases there is a history of syphilis, either inherited or direct. Many cases can be traced to an inherited neuropathic tendency; that is, to previous cases of insanity or other nervous troubles in the ancestors. Exposure to wet and cold may act as a cause. According to Gowers, it may follow attacks of rheumatic arthritis of the knee- and ankle-joint. The most frequent cause, however, is injuries causing concussion of the spine—a fall on the back, or a blow.

The disease often sets in almost imperceptibly and the symptoms continue to develop in a very slow and gradual manner. It begins, as a rule, with a weakness of the lower limbs; at first the legs tire out more easily than usual; this progresses steadily to a well-marked condition of paresis: associated with the paresis there may be more or less muscular

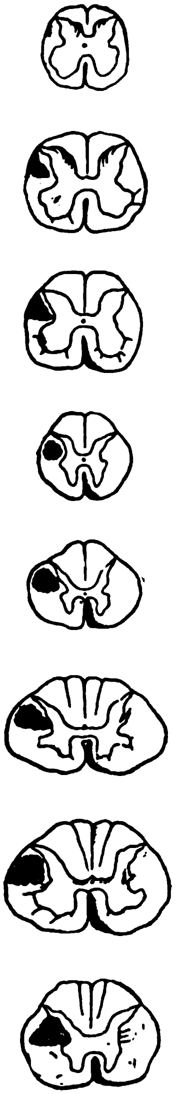


Fig. 58.—Transverse Sections of the Cord Showing Secondary
ing Degeneration Following a Lesion of the Brain. (After Erb.)

twitching, or even slight spasms of the muscles. The
tend to become stiff and rigid. Spasms of the musc
excited whenever the patient moves the legs, or when

nents are attempted. This is due to the fact that the reflexes are very much exaggerated in this disease.

e reflex action is ordinarily controlled by inhibitory filas running from the brain to the gray matter of the cord, gh the antero-lateral columns of the cord; and if anything ens to interfere with the integrity of these filaments, the acts lose inhibition and run riot. The reflexes (knee-etc.) are all exaggerated. It is in spastic paraplegia only a typical foot-clonus is produced. Often the foot-clonus pronounced that it is necessary for the patient to have the flat upon the ground in order to stop the spasms in the les. The spasms are confined chiefly to the extensors, and excitation causes the limb to straighten out and become and rigid. This accounts for the peculiarities in the gait ese patients.

s very difficult for such patients to go upstairs, on account e toes catching on the steps. The legs are generally kept together, owing to a spasmodic contraction of the adducof the thighs; the toes trail or are dragged along the nd, and when the ball of the foot touches the ground, a nodic contraction of the calf muscles may take place, by raising the patient upon his toes irrespective of his will, hus causing a "hopping gait." The pelvis and the limb, whole, are lifted in order to allow of the scraping of the foot rd, because little if any flexion is made of the knee. The ns of the adductors of the thigh have a tendency to cause nees to become interlocked when attempting to walk. In way a mixed and very irregular kind of progression is seen, y to be counted for by mere paresis and partly by the rrence of strong muscular spasm. Early in the affection patient is obliged to depend upon canes for support.

peculiar attitude of the back and chest is observed as the nt leans heavily, first on one cane and then on the other, der to raise the weight of the body by the arms. The back ongly arched and the chest is thrown very much forward. ney.)

As the disease progresses the trunk muscles and th
extremities may become involved. When the ar
affected, the flexors eventually become contracted and d
arms to the side. Sensibility is little if at all affected; h
some cases are troubled with a dull rheumatoid pain in t
and legs. There are no trophic changes in the skin a
little, if any, atrophy of the muscles. No interference w
functions of the bladder and rectum, with the exceptio
a few cases are troubled with hasty micturition. The r
are exaggerated (the knee-jerk and foot-clonus). The
cal reaction of the affected muscles is normal or only s
diminished. In the later stages of the disease the patie
unable to walk and are obliged to remain in bed. In suc
the legs are usually stiffly extended and drawn closely to
the feet being turned inward.

Diagnosis.—The gradually progressive weakness; t
aggerated reflexes; above all, the *foot-clonus;* the spast
so characteristic of the disease; the absence of sensory, s
rectal, and bladder symptoms. All these form a
defined symptomatic picture of this disease.

Prognosis.—In the early stages there is some prosp
arrest, and even of improvement, and in some cases of curi
patient entirely. When, however, the disease has once b
fully developed, the only result that can be expected is to
it: the great majority of cases, however, have a tenden
steadily progress.

Treatment.—The treatment in the main is similar to t
locomotor ataxia, but in addition to that the electric bat
proven a valuable agent in the treatment of this affection

Professor Morton gives the following instruction in r
to its use: The *positive* pole is *always* placed at the *hea*
that the current enters the spinal cord between the shou
The current seems to have some specific action on the
and tends to reduce reflex excitability. Under this t
ment the spastic gait is improved and the tendency to
spasms decreased. A course of baths may consist of

o fourteen, one every day for five or six days, and then
her day till the end of the course; each bath continuing
ı to fifteen minutes.

lerosis of the Lateral and Posterior Columns.

(*Ataxic Paraplegia, Progressive Spastic Ataxia.*)

s an affection due to a degeneration and sclerosis of the
ınd posterior columns of the spinal cord characterized
ymptoms of spastic paraplegia and ataxia. It is more
ı in males than in females, and occurs more frequently
niddle period of life. The causes in some cases are
It has been known to follow concussion of the spine,
osure to cold and wet. The symptoms consist of con-
s and exaggerated motor reflexes, the combination of
o classes of symptoms causing a peculiar walk, known
smodic or spastic gait.

nset of the disease is usually slow, but gradually pro-
. The first symptoms are heaviness, numbness, and
in the lower limbs, with an inability to stand with the
sed. The upper extremities may become affected
to the lower, though rarely. The gait is usually
y on account of the ataxia or inco-ordination. There
ensory symptoms, with the exception of tenderness in
on of the spine and occasionally a dull pain in the legs.
rely do they have the lightning pains of locomotor
The knee-jerk is exaggerated, and sometimes the foot-
an be elicited. The sphincters are not usually involved.
cases they may have the Argyll-Robertson pupil, in
ses atrophy of the optic nerve, but these conditions
. There is little or no atrophy. Sexual power is
ost early in the disease. As the disease progresses the
eakness may go on to complete paralysis.

hief symptoms are inco-ordination in the early stage
sease and spastic palsy in the later stages; exaggerated
k. As Gowers has rightly put it, *ataxic* paraplegia is
araplegia *plus* inco-ordination.

The prognosis is unfavorable as regards improvement c The treatment is that applicable to locomotor ataxia.

Chronic Spinal Muscular Atrophy.

(Progressive Muscular Atrophy, Amytrophic Lateral Scle Wasting Palsy.)

This is an affection due to the slow degeneration of the and trophic cells of the anterior horns of gray matter spinal cord, associated with a chronic degeneration pyramidal tracts of the cord; or, in other words, as Gow expressed it, it is the visible expression of a tendency to of the whole motor path from the cortex of the brain muscles. It is characterized by motor paresis, mu atrophy, contractures, and exaggerated reflexes, withou bral, sensory, vesical, or rectal symptoms.

This affection is one of the most chronic and incurable spinal diseases; it is comparatively common, and has described under various names. Some writers have atte to classify it as to whether the seat of the lesion was co mainly to the pyramidal tracts or to the anterior horns. the degeneration invaded the pyramidal tracts, the diseas termed "amyotrophic lateral sclerosis" by Charcot upo assumption that these columns were its primary seat; wh nerves and muscles were primarily attacked, it was ter "progressive muscular dystrophia"; when the anterior and the pyramidal tracts were the first to be attacked, th ease was commonly referred to as a "progressive mu atrophy"; but Gowers, Leyden, and others claim that th not enough difference between the symptoms of these dif varieties to warrant a separate classification, and that should therefore be described as one affection—namely, ch spinal muscular atrophy.

Ætiology.—This affection occurs more frequently in than in females. It is essentially a disease of middle life occurs most commonly between the ages of thirty and years. Heredity has an influence upon its production. A tendency to the disease is certainly inherited in not a few of the cases, and sometimes this may be traced through several generations. In other cases there is no history of a direct transmission of the disease, but there is a history of the transmission of a neuropathic taint. Exposure to cold, dampness, prolonged mental anguish, syphilis, injuries such as falls or concussions of various kinds, a toxic condition of the blood from blood-poisoning, etc., may all act as causes. In many cases no cause can be assigned.

Symptoms.—The chief symptom is the development of extensive and progressive atrophy of certain muscles, with a corresponding degree of paresis, as the disease progresses; actual paralysis manifesting itself only as the final event in the completion of the atrophic process. The whole muscle does not waste away simultaneously, but only bundle by bundle or fiber by fiber. There is a tendency for the single muscles or a group of muscles to escape atrophy while all the surrounding muscles are profoundly affected. Accompanying this wasting there occur fibrillary contractions; these consist of slight twitchings of separate bundles of muscular fibers. When they are temporarily absent, they can be produced readily by striking the skin over the affected muscle.

In the majority of cases the disease begins in the upper extremities, either in the deltoid or hand. If in the hand, the thumb usually is the first affected; the ball of the thumb becomes flattened and the patient cannot abduct or flex it. The corresponding muscles in the opposite limb are usually simultaneously affected. The one side may be affected first and when it has attained a marked degree the other side may then become affected.

From the parts first affected the disease spreads to the other parts of the same limb. In the forearm the extensor muscles suffer more frequently than the flexor. When the atrophy is extreme in the interossei and muscles of the wrist, the fingers become partially flexed and contracted in a peculiar manner, so

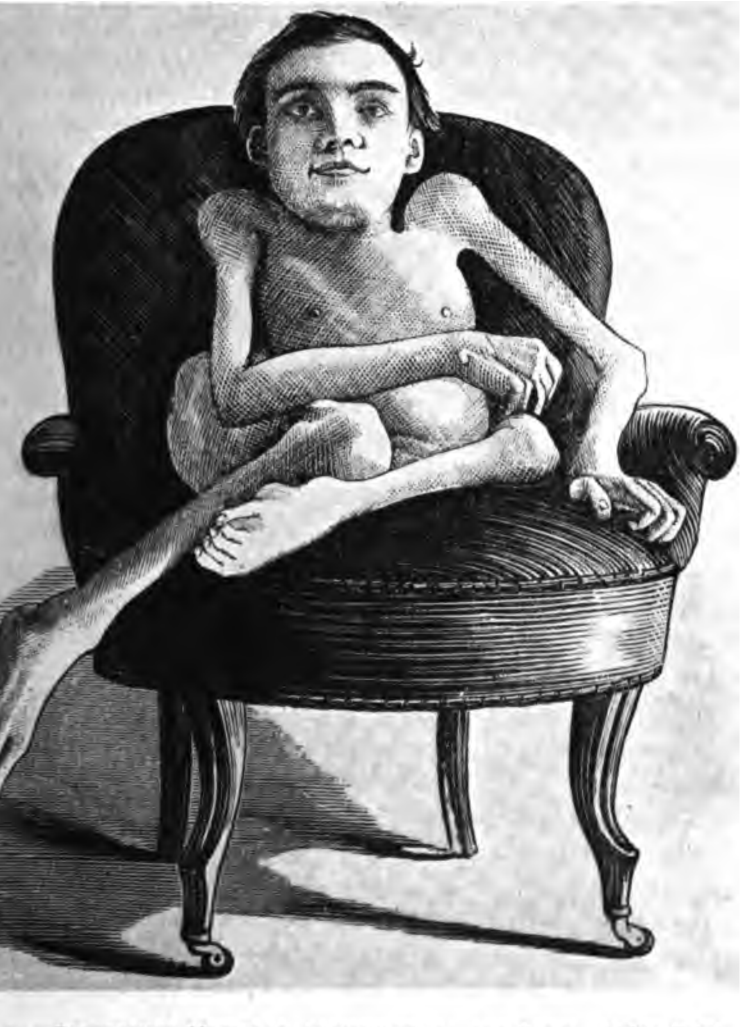
as to produce a fancied resemblance to a bird's claw; l
name "claw-hand." Sooner or later the hand as
characteristic deformity on account of predominance
in the extensors and abductors of the thumb giving ri
so called "ape-hand."

In a few cases the atrophy begins in the shoulders a
first, attacking the deltoids, biceps, and triceps, then e
downward to the hands. The wasting of the deltoid
followed by that of the muscles of the scapula. After
or shorter interval, the disease in these cases is apt t
to the trunk muscles generally. Later on the low
become involved; the atrophy, however, is slighter i
than in the upper extremities. In very rare cases, ho
begins in the legs and ascends. In the last stages of th
there is evidence of extension of the morbid process up
the cervical region and the medulla, causing bulbar p
followed by atrophy of the tongue and lips, and death ul
through paralysis of the respiratory muscles. In th
affected the atrophy always precedes the paralysis.

In the later stages there may be various kinds of
ties on account of the unequal affection of antagonistic
also there may be rigidity and contracture of the
muscles. There is no anæsthesia. In some cases the
may be troubled with dull rheumatic pains in the
parts, or they may suffer from paræsthesia. There
tendency to the formation of bed-sores; the skin, howev
appear mottled or of a bluish-red color over the wasted
There may be slight ataxia. The reflexes are exagge
the early stages, but as the disease advances they beco
and are finally abolished. The electric contractility
affected muscles is not diminished so long as there
muscular fibers to be acted upon. The sphincters are
involved. The sexual power is usually diminished or
lost.

Diagnosis.—The diagnosis is made from the slow
gressive character of the atrophy; from the fact that the

les the paralysis; and that the atrophied muscles respond
faradic current as long as there are any muscular fibers



59.—Progressive Muscular Atrophy of all the Limbs. (After Fried-
Age of the patient forty-five years.

acted upon—that is, as long as any fibers in the muscle
remain free from fatty metamorphosis.

Prognosis.—The prognosis is grave and uncertain, ye same time there is a possibility of arresting the diseas early stages. It may limit its manifestations to certain and then become arrested spontaneously. In other though the disease is strictly progressive for a time, its a may after a while, under the influence of treatment, con standstill; the great majority of cases, however, steadi gress to a fatal termination. Its duration may vary an from five to thirty years, or more, but, on the average, over ten or twelve years.

Pathology.—While the salient feature is the slow was the muscles, the cause of the atrophy is due to a degenera cells in the anterior horns; the motor nerve-fibers, whic from the anterior horns and proceed to the muscle degenerate, while at the same time there may also e degeneration of the pyramidal tracts in the cord traceabl to the cortex, with bulbar and other symptoms of diseas higher level than that of the cord.

Treatment.—The essentials of treatment are rest an tricity. In this affection electricity is applied not alone affected centers, but also locally to the affected muscles. faradization and galvanization of the entire length of the are recommended. Duchenne advises faradization of a affected muscles, combining with this, however, a further cation of the positive pole of the continuous current up vertebral column and the negative over the affected m Erb prefers galvanization alone, stabile, with both pol mild current to the affected levels of the cord. M advises the use of a spinal electrode 1½ inch in wid 18 inches in length, and a sternal electrode 7 by 8 i The spinal positive, the sternal negative. After ten mi current-flow, the spinal electrode to be replaced, the s still *in situ*, by another electrode, which is to be labile over the affected muscles with positive electricity says that from personal experience he prefers the fra current—long percussive sparks to the vertebral co sparks, such as are easily borne, to the muscles; al or rubbing electrode to the entire skin surface; and insulation or bath during twenty minutes. In addition he places great store by the static induced current, e says is especially adapted to reaching and influencing al marrow.

ccount of the slow and progressive nature of the disease, edies will have to be chosen to suit the disease in each al case. Those called for most frequently are glonoine, e, aurum, barium, argent. nit., strychnia. Strychnia is edy *par excellence*. In a few cases with a syphilitic mercurius and kali iod. have proved useful. On the however, treatment has availed very little.

Multiple Sclerosis.

(*Insular or Disseminated Sclerosis.*)

is a disease produced by the formation of scattered sclerosis (overgrowth of neuroglia) of varying size and hroughout the brain and spinal cord. According to sification of Charcot, there are three types of the disease: spinal, in which the disease is confined to the spinal 2. Cerebral, in which the disease is confined to the cere- 3. Cerebro-spinal, in which both brain and spinal cord cted.

CEREBRO-SPINAL TYPE.

cerebro-spinal type, for all practical purposes, may be d as the typical form of the disease, and as the chief ms of the disease are often those of the spinal type, even here is also an extension of the morbid process to the m, it will be better to describe it in connection with the of the spinal cord.

ology.—The disease develops in the early part of adult urring more frequently between the ages of fifteen and ive.

me cases it can be traced to a direct hereditary tendency,

but generally the patient simply inherits a neuropa
tution. Among the exciting causes are exposure
dampness, traumatism, mental overwork or exce
labor, or some infective fever, such as typhoid,
cholera, measles, etc.

Symptoms.—The symptoms will vary in diff
according to the varying situation, extent, and or
lution of the morbid patches. Multiple sclerosis
possessing no absolutely characteristic sympto
instances have been reported in which the lesions
sclerosis have been revealel at the autopsy, while th
during life were those of a different affection
describes the case of a patient in whom there were
"triple superposition" the symptoms of *tabes,*
sclerosis, and *hysteria.* Grasset reports a case in
symptoms of hysteria were so conspicuous that a
multiple sclerosis, which was suspected as a possib
not be established until the autopsy. The patie
affected for years with a dull pain in the limbs, or
numbness in the hands and feet, before there are a
signs of the disease.

Among the first things which the patient observe
ness in the limbs, a gradually progressive paresis, u
arm or leg, beginning in one limb and then, after
time, in the other. In other cases a peculiar inco
in the hands, or in one alone, is the first indication
ease. During the early stages of the disease there a
distinct remissions. Soon a marked symptom makes
ance—*tremor,* which is of a jerky, irregular characte
be limited to a single muscle of the leg or arm, or
one or more of the limbs. In some cases this tremo
that of paralysis agitans, while in others it partak
the movements of chorea. Excitement of any kind
lar efforts invariably cause the spasmodic movements
markedly intensified; they are also increased by atten
symptoms usually subside when the voluntary exert

arm be affected, its movements become uncertain; writ-
omes difficult or even impossible; dressing or undressing
es extremely difficult. As the disease progresses any
t to write results only in irregular strokes on the paper,
hand dashes to and fro.
difficult for them to take hold of an object; in attempt-
do so the arms are thrown about in a wildly irregular
and move in quick, sudden jerks, now in one direction,
another, until at last, by a great effort and sometimes
sudden dash, the patient succeeds in grasping the object.
rs.)
upper extremities are affected more frequently than the
with this choreic movement. The tendency of the
is always to extend. Beginning in an extremity or a
of muscles, or only in a single muscle, it goes on attack-
hers until at last all the limbs, and even the head, may
affected. Accompanying this tremor there is a gradu-
ogressive paresis of the arms. Later some paresis of the
muscles may occur, as well as those of the neck; and this
followed by a similar affection of the tongue and lips.
the legs become affected, the gait closely resembles that
alysis agitans; there is also inco-ordination. The knee
ot are apt to move involuntarily when the patient is
or reclining. The tendon reflexes are aggravated;
clonus may be obtained with readiness. The weakness
legs gradually increases till paralysis is developed.
on the legs become rigidly extended as in spastic
egia. (This is indicative of degeneration of the lower part
pyramidal tracts.)
he earlier stages the functions of the bladder and rectum
usually impaired, nor is there a tendency to the forma-
bed-sores. Later on, however, control is lost of the
cters, there is an inability to retain the urine or fæces, and
s also a tendency to the formation of bed-sores. There
wasting of the muscles, nor is electro-muscular con-
ty ever diminished. There may or may not be sensory

symptoms, according as to whether the sclerosis invo sensory tracts or not. The cranial nerves may be inv the optic, causing impairment of sight; the facial, causi spasm of the facial muscles; or the fifth, in which c manifested by severe pains in the course or distributio nerve. Nystagmus is a common symptom. Verti symptom of quite common occurrence. The special se be impaired late in the disease. Smell, taste, sight, and have been known to be individually destroyed. In t stages the patient shows signs of mental decay; there is expressionless aspect of the face; the patient becomes in manner; his memory fails; he takes interest only i laughs constantly, also at mere trifles; or, on the oth is very easily moved to tears. Attacks of apoplectiforn leptiform seizures are liable to occur.

Diagnosis.—In the early stages it is difficult, and so impossible, to make a positive diagnosis. Whenever t gradually progressive paresis, accompanied by *jerky* *larity* or *tremor*, it is pathognomonic of multiple sclerosi

Prognosis.—The prognosis is unfavorable; yet in so remissions, and even a slight improvement, may occur.

Course and Duration.—The course of multiple scl progressive. The duration of the disease varies from fifteen years, the average duration being five or six yea

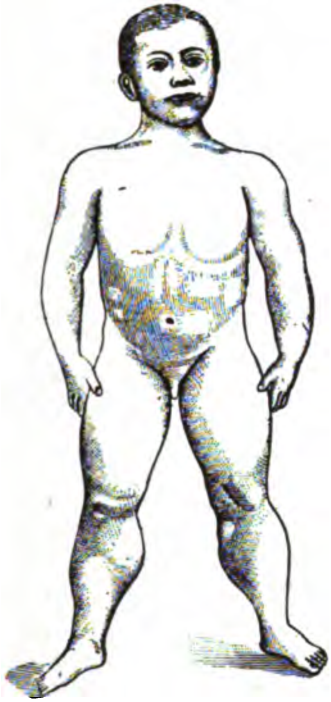
Treatment.—The same line of treatment given fo degenerative diseases of the nervous system—for insta *motor ataxia*—must be employed.

Pseudo-Muscular Hypertrophy.

(*Pseudo-Hypertrophic Muscular Paralysis.*)

This is a primary disease of the muscles, consistin overgrowth of the interstitial tissue, followed by a wa the muscular fibers. It was formerly supposed to be du inflammation of the anterior tract of gray matter of th cord, but later researches show that it is a *purely l* *idiopathic* disease of the muscles. Even though the ve no strict title to a place among diseases of the spinal t will be convenient to briefly refer to it here, since its stic relations are certainly with these affections.

ology.—As to its cause very little is known. It is con- lmost exclusively to infancy and childhood. Heredity y important factor, the hereditary influence being almost



.—Attitude of Pseudo-hypertrophic Muscular Paralysis. (After Duchenne.)

transmitted from the mother's side. Gowers claims that sease is congenital, the result of a perverted tendency of h, inherent in the embryo and derived from the germ hich the embryo proceeds. It occurs more frequently es than in females. Injury and acute disease sometimes r to act as exciting causes.

nptoms.—The first symptom of the disease consists in ness of the legs, together with an unsteady, stumbling gait. The legs are separated widely in standing or walking; the belly is very prominent and the back is much curved in the lower dorsal and lumbar region, while the shoulders project backward. A plumb-line dropped from the most posterior part of the spinous processes of the vertebræ, when the child is standing, passes far behind the sacrum; thus showing the remarkable degree of incurvation of the spine in the lumbo-sacral region. The child has a peculiar, awkward, waddling gait, somewhat resembling that of a duck. Soon an apparent hypertrophy of the leg muscles, particularly those of the calves, develops, and as a result of this atrophy and a consequent weakness of the leg muscles the gait becomes more waddling and the child has great difficulty in going upstairs or getting up when on the floor. Its mode of rising from the floor is characteristic of this disease. The child has to catch hold of something to pull itself up; but if there is nothing near for it to take hold of,

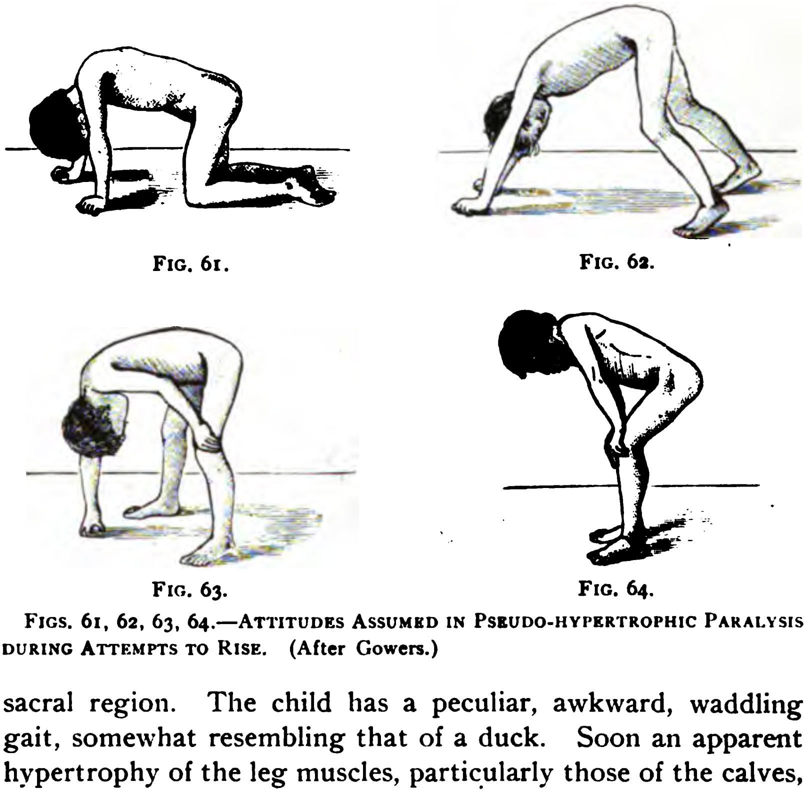


FIG. 61. FIG. 62.

FIG. 63. FIG. 64.

FIGS. 61, 62, 63, 64.—ATTITUDES ASSUMED IN PSEUDO-HYPERTROPHIC PARALYSIS DURING ATTEMPTS TO RISE. (After Gowers.)

it places one hand on the floor, the other on one knee, and then pushes itself up. Later other muscles, as those of the back, shoulder, etc., are similarly affected, and as the hypertrophy increases the paralysis becomes more apparent, and finally the child is confined to a recumbent position. After a few years, the hypertrophied muscles atrophy and wither away.

In consequence of the weakness and contractures of the leg muscles there early develops a *talipes equinus*, and later the legs may become flexed on the hips and the forearms on the arms. The sensory functions are very little impaired. The functions of the bladder and rectum are not usually involved, except possibly in the last stage. The knee-jerk is always lessened and in time is lost. The faradic irritability is always lessened, but the galvanic is usually increased. In the later stages the child shows signs of more or less mental deficiency, in some cases becoming idiotic.

Diagnosis.—The gradual progressive weakness, the peculiar awkward gait, and the apparent hypertrophy of the calves of the legs.

Prognosis.—Unfavorable; death usually takes place in five or six years, occurring usually from some intercurrent disease on account of the lessened vitality, and not directly due to the disease itself.

Treatment so far has proved of very little benefit in arresting or modifying the disease.

Acromegaly.

(*Marie's Malady.*)

This is a chronic disease, characterized by gradual enlargement of the hands, feet, head, and thorax. Very little is known of the causation. No hereditary influence or definite exciting cause is known. The disease usually begins in the hands. The hands become enormously enlarged, more in width and thickness than in length, so that the term " battledore " or spade-like hands has been given to them. The hypertrophy affects the soft part as well as the bones. In the course of time the head also increases in size; all the soft structures of the face are thickened. The lower jaw is much more involved than the upper. The chin is an especially prominent feature, being massive, projecting downward and forward. The tongue, lips, and nose are enormously hypertrophied. The thorax is enlarged antero-posteriorly and flattened. There may be curvature of the spine in the cervico-dorsal region. Sooner or later the feet are affected in the same way as the hands. The heart also becomes enlarged.

The symptomatic signs are: An intense and persistent occipital headache; an increase of perspiration which may sometimes be of a disagreeable odor; polyuria; pains in the bones and joints, of a rheumatic character. Rarely is there any anæsthesia. There is no paralysis. There is disturbance of the sexual functions; in women amenorrhœa; in men loss of sexual power.

The prognosis is unfavorable as regards a cure; but as regards life, it does not very materially shorten its duration. Cases have been known to last from ten to thirty years, or even more. Death usually results from some intercurrent disease.

Treatment avails very little, being only palliative.

Syringo-Myelia.

(*Cavity in the Spinal Cord.*)

This is a rare disease. It may be either congenital or acquired. It is a chronic, slowly progressive disease, characterized by peculiar disturbances of sensation and nutrition.

There are no positive symptoms of this affection. Rarely can it be recognized during life; the lesion being discovered only at the *post-mortem*. The duration of the disease may be fifteen or twenty years, or even longer. At times there may be remissions, and even a slight degree of improvement.

Spina Bifida.

Spina bifida is a congenital hernia of the spinal membranes, and sometimes of the cord, through a cleft in the vertebræ, caused by absence of the vertebral arches. It occurs most frequently in the lumbo-sacral region, rarely elsewhere. The tumor may vary in size from one inch to eight inches in diameter, and may have a broad base or be pedunculated.

The character of the swelling may be recognized by its congenital origin and by its location in the median line of the back. It will vary in size at different times, being larger during the act of crying; also it may be reduced in size by pressure, its contents being forced back into the spinal cord and ventricles. In the great majority of cases there is paralysis (paraplegia) of the lower extremities. The paralysis may be followed by various contractures, resulting in various kinds of deformities.

The prognosis is unfavorable. Ulceration of the tumor is liable to occur and allow the cerebro-spinal fluid to escape, thus resulting in convulsions and death. In other cases, however, the tumor may remain indefinitely in about the same condition as at birth. The treatment is chiefly surgical. In many cases a cure may be obtained by injections of Morton's fluid: Iodine, grs. x.; iodide of potassium, grs. xxx.; glycerine, ℥ j. From ℥ ss. to ℥ j. or more of the fluid is withdrawn from the sac, and from ʒ ss. to ʒ iij. of the iodine solution is injected, and the puncture covered with collodion. The injection should be made in the lateral portion of the sac. The operation may be repeated if necessary. This line of treatment is only justifiable when the tumor is well pedunculated and the communication between the sac and membrane of the cord is not large. Puncture and withdrawal of the fluid, with compression, has been advocated, but has proven unsuccessful. Prolonged compression is liable to induce convulsions.

FUNCTIONAL DISEASES OF THE SPINAL CORD.

Spinal Irritation.

(*Spinal Neuralgia.*)

This is a functional disorder characterized by a severe pain, involving a greater or less portion of the spinal column, and associated with this pain there is marked tenderness over the spinous processes of the vertebræ and the adjacent spine.

Ætiology.—Spinal irritation occurs more frequently in females than in males. It may be produced either by anæmia or hyperæmia of the spinal cord. Other causes are: A general debility of the nervous system; exhausting diseases; hemorrhages; over-lactation; reflex irritation from diseases of the sexual organs. One of the most frequent causes is traumatism, resulting in shock or concussion of the spinal cord. The effect may not be manifested for six months or a year after the injury, and the pain probably depends upon a neuralgic state of the nerves of the joints and ligaments of the spine, or of those of the membranes of the cord.

Symptoms.—The chief symptom is pain in the region of the spine, aggravated by pressure. The pain may be felt at one or more spots, or it may extend along a considerable length of the spine. The pain is usually located either between the shoulder-blades or in the lumbar region, but it may pass upward to the occiput or radiate downward along the distribution of the sciatic nerve. It is occasionally referred to the sacrum, and described by the patient as a weight, an ache, or a mere vague discomfort. In many cases there is no pain except when pressure is made on the affected portion of the spine, so that the real nature of the disease is liable to be overlooked. These sensitive spots are found most frequently in the cervical, lower dorsal, and lumbar regions, and correspond to the portions of the spinal cord from which the nerves supplying the head and upper and lower extremities are given off. These spots are sometimes so exquisitely sensitive that the least pressure causes intense pain. In rare instances the spine may be extremely sensitive throughout its entire length. At times the pain may assume the features of a true neuralgia, coming on in paroxysms, aggravated by exertion and posture.

There may be headache, vertigo, nausea, insomnia, and vomiting. There may be convulsions, during which the head and feet bend backward until they almost meet. Other cases may be subject to a distressing dyspnœa or hyperæsthesia or anæsthesia, or numbness, formication, or even paresis of the upper or lower extremities; still other cases may be affected with various forms of neuralgia, as gastralgia, ovaralgia, etc.

Diagnosis.—The diagnosis is sometimes very difficult. The spinal tenderness, in the absence of organic spinal disease, is the chief diagnostic symptoms.

Prognosis.—Favorable as a rule.

Treatment.—The first object is to find and remove the cause, if due to reflex troubles. Rest, outdoor exercise, and good nourishing diet are all points to be considered in this affection. All-around orificial work will be called for in many cases, and if not sufficient of itself to complete a cure, will pave the way for the indicated remedy. Remedies, the action of which before seemed to be inert, will then respond with brilliant results.

Electricity.—In electricity we have a most efficient remedy. When the galvanic current is used, the spine should be thoroughly galvanized. When the whole cord is to be brought under the influence of the current, one electrode is placed on the upper and the other on the lower portion of the spine; or one electrode is made stationary and the other passed up and down the entire length of the cord by labile applications. Benedict recommends that the positive pole be placed on the spine above the diseased portion of the cord, and that the negative be slowly passed up and down the vertebral sides of the column. The back is not usually sensitive, and a strong current can be borne without discomfort. Where one or several vertebræ are painful or sensitive to pressure, the treatment should be directed to those parts.

In static electricity we have an agent which I think will even surpass galvanism. In using this form of electricity we have to be governed by the general condition of the patient. If the case is one of anæmia, the patient should be insulated with the positive pole, and either the static breeze or negative sparks applied up and down the spine. The reverse of the poles in such a case would be followed by an aggravation of the symptoms. In other cases—that is, those that are not anæmic, and especially in cases that are of a very nervous condition—the best results are obtained by negative insulation, with the positive breeze or sparks applied up and down the spine. This has a tendency to reduce the excessive irritability, and in many cases a few applications will relieve the pains.

In regard to the therapeutical treatment, it would be impossible to give all the remedies and the indications for each, on account of the multiplicity and varying character of the symptoms. Therefore only a few of the most characteristic remedies will be given.

Zincum val.—Zincum is one of our most useful remedies in spinal irritation, especially when due to reflex causes. It is indicated where there is a dry, spasmodic cough; also great dyspnœa. There is a burning pain through the shoulders, or it may extend along the entire length of the spine; worse when sitting; relieved by walking; great weakness of the lower limbs.

Actea rac.—Actea seems to affect the whole cord as shown by its action upon both the nerves of motion and sensation. It is especially indicated when the upper and lower cervical vertebræ, particularly the latter, are sensitive to pressure; hence the patient will not lean back in her chair on account of the uneasiness which it produces; there is severe headache, marked vertigo, pain in the dorso-lumbar region, and weakness of the lower limbs. It is *the* remedy in those cases where the neuralgia is not confined to any particular set of nerves, but changes from one part to another. Especially indicated in women who are more or less affected with ovarian and uterine disease.

Belladonna.—Pain and tenderness along the spine; pain shoots into the limbs; pains of a neuralgic type; in females where there is a sharp, stitching pain in the ovaries, that comes and goes suddenly; where there is a severe bearing down pain, with a constant ache in the back.

Gelsemium.—Great weakness of the limbs with deep-seated muscular pains; numb feeling, as if the limbs were going to sleep; pain along the whole length of the spine, or a dull, heavy pain in the sacral region.

Hypericum.—Spinal tenderness, with paroxysms of terrible pain, screaming if approached; in other cases, great sensitiveness of the cervical vertebræ to touch, with dyspnœa, short, hacking, nervous cough, chilliness, worse in damp weather; paroxysms of terrible pain, especially after a fall on the coccyx. Hypericum is indicated more especially in those cases that are the result of previous injury (especially railroad accidents) causing concussion of the spinal cord.

Ferrum phos.—Anæmia, with pale face and blue lips, and great debility; easily exhausted from the slightest exertion; face becomes suddenly fiery red, with vertigo, ringing in the ears, great palpitation of the heart and dyspnœa.

Strychnia.—Constant pain in the small of the back; numbness, pricking sensation in the extremities, or a tired, bruised feeling of the extremities.

Ignatia.—Headache, with a weight at the back of the head, and a tendency of the head to incline backward against the back of a chair or something hard; a dry hacking cough; great dyspnœa; gastralgia; feeling of weakness in the epigastrium with great depression; feet and legs numb and cold up to the knees; hands cold.

Physostigma.—This remedy develops a perfect picture of spinal irritation. Every nerve of spinal origin is irritated under this drug; pressure of the finger between the vertebræ causes the patient to wince; burning and twinging sensations referable to the spinal column, with numbness of the feet and hands and other parts of the body; crampy pains in the hands; sudden jerking of the limbs when dropping off to sleep; rigidity of the muscles of the back and even a tetanic condition.

Cocculus.—Pain in the lower part of the spine, and trembling of the limbs; constant pain in the back, shooting through the body to both sides and along the spine to the occiput and even to the temples, at times aggravated by walking and stooping; tenderness on pressure on vertebral spines, from the last dorsal vertebræ to the sacrum; frequent giddiness; does not fall asleep until late on account of pain.

Nux vom.—Backache in the lumbar region, worse in bed; sudden loss of power in the legs in the morning; hands and feet go to sleep easily; stiffness and tension in the hollow of the knees; clothing about the waist feels too tight; sensation as of a band about the waist; desire to lie down; numbness and formication along the spine which extend into the extremities.

Sulphur.—The back is so sensitive that any sudden jarring of the body causes pain; there is a dry heat especially in the small of the back, and is often associated with cold feet.

Agaricus.—Stitches, soreness, aching, deep-seated; burning in spinal column, generally in upper dorsal region; worse from walking in the open air, and touch; better in bed. Agaricus is especially indicated where there are fibrillary twitches of certain muscles or groups of muscles.

Phosphorus.—Dorsal spine sensitive to pressure; burning between the scapulæ; worse lying on the left side; great prostration.

Natrum mur.—Spine oversensitive to touch or pressure; tension and drawing; pains better lying on something hard; sensitiveness between the vertebræ; patient weak and nervous; fluttering of the heart; partial paralysis from weakness of the spine; spinal irritation, especially from grief, anger, sexual excess; symptoms better when lying on the back; pain and tenderness in the back better from firm pressure.

Acute Ascending Paralysis.

(*Landry's Paralysis.*)

This is an affection characterized by a rapidly progressive motor paralysis, which begins in the legs, passes upward, involving the trunk, upper extremities, and respiratory muscles, without marked sensory symptoms, and usually ends in death.

Very little is known of its ultimate cause, as there are no morbid changes in the spinal cord, nerves, or muscles; but the later researches favor the theory that it is due to a toxic influence acting on the nerve-centers. It has been known to follow blood-poisoning diseases, as small-pox, diphtheria, typhoid, pyæmia, rheumatism, etc. It occurs principally in persons between the ages of twenty and forty, and more frequently in males than in females.

Symptoms.—Usually for a few days, or even weeks, preceding the definite manifestations of the disease, the patient may complain of a sense of weariness, headache, backache, and more or less numbness or tingling sensation in the extremities, especially in the tips of the fingers and in the feet.

The first definite sign of the disease is weakness in the legs, which is soon followed (from a few hours to a few days) by complete paralysis, with relaxation of the muscles. The paralysis soon involves the muscles of the trunk, arms, and of respiration. It soon travels upward, involving the respiratory and circulatory centers, death resulting from either respiratory or cardiac paralysis. In rare cases the disease begins in the medulla or cervical region and travels downward. Sensation is very little affected, if at all. The deep reflexes are abolished; but in cases that recover they gradually return as the paralysis disappears. In cases which prove rapidly fatal the loss has continued till death. The sphincters of the bladder and rectum are not involved. There is no atrophy. No change in the electrical irritability. There are no bed-sores. There is no impairment of the mental faculties.

Diagnosis.—The rapidly progressive motor paralysis, which, as a rule, is ascending, with relaxation of the muscles during the acute stage of the disease; no atrophy, and the electrical reactions in no way differing from those met with in healthy nerves and muscles.

Prognosis.—Grave. In many cases the disease runs its course and ends fatally in forty-eight hours; the majority of the cases, however, that prove fatal last from three to six days. But all cases do not run so rapid a course; some cases may continue for three or four weeks, or the disease may be arrested at any stage of its progress, even after the paralysis has ascended to the arms. When the disease, however, has advanced so far as to seriously implicate the medulla, recoveries are comparatively rare. Improvement, when it occurs, is slow, requiring as a general rule from three to six months; although occasionally a case may recover within a few weeks.

Treatment.—The treatment is similar to that for *multiple neuritis*, which compare.

Thomson's Disease.

(*Myotonia Congenita.*)

This is a disease characterized by a tonic contraction of the muscles, which comes on when they are first put in action, after a period of rest. This spasm or contraction of the muscles is transient, gradually passing off, and as long as movement is continued the patient has complete control over his muscles. The muscles of the lower limbs are more frequently affected than those of the upper. Every voluntary muscle in the body may, at some period or other, be affected. The involuntary muscles are spared. The spasm is increased by a morbid fear of it; by a cold and by nervousness; also the longer the rest the more severe the spasm.

The muscles are somewhat hypertrophied, and the patient may present the appearance of a very strong man. As a rule, the general health is not affected. It affects males more frequently than females. It is practically always hereditary, runs in families, and may affect several members of the same family.

Dr. Thomson, whose description gained for it general notice, and who suffered from it himself, noted its occurrence in five generations of his own family. There are rare cases, however, where seemingly it had been acquired in the adult period of life from fright, or long-continued exertion.

The prognosis is bad as regards cure, but the disorder does not materially shorten life.

Treatment appears to have very little effect on the disease.

Writers' Cramp.

(*Scrivener's Palsy.*)

This is a disease characterized by a tonic, spasmodic contraction of certain muscles of the hand and arm when attempting to perform certain movements, as writing, etc. It is met with more frequently in those who are accustomed to do a great deal of writing; it is also met with quite frequently in piano-players, violinists, telegraph operators, and seamstresses.

Symptoms.—Previous to the appearance of definite symptoms, the hand feels strangely tired, and an aching pain in the fingers, hand, or arm makes it difficult for them to pursue this occupation. This symptom may continue for a week or month before any other symptoms manifest themselves. Then the patient begins to notice a peculiar awkwardness in the finger movements; a sense of stiffness in the fingers; the finger slips off the pen; he writes more slowly than usual, or there is a tendency to uncontrollable spasm of the fingers when these acts are continued, so that to get relief, he lays down the pen, rubs the hand and arm, and then is able to continue his work. These symptoms may gradually increase in severity until it is impossible for him to control his fingers or hand. In writing the pen may be flung from the hand, or may cause an unintended stroke or a zigzag line on the paper. Accompanying this spasm there is often tremor of the hand, which ceases as soon as the attempt to write is stopped. The spasm is usually limited to the act of writing or other employment which produces it; otherwise they can use their affected hand for any other purpose without the slightest difficulty. In some cases there is slight loss of power in the affected hand and arm; the grasp is a little weaker than normal. The electrical irritability to the faradic current is slightly diminished in many cases.

Diagnosis.—The diagnosis is not so difficult when the disease becomes well established. In the earlier stages, however, it may be confounded with various diseases that have tremor, such as progressive muscular atrophy, locomotor ataxia, post-hemiplegic chorea, etc.

Prognosis.—The prognosis is not very good. Undoubtedly many cases make a complete recovery, but when the disease becomes fully established, it will usually continue throughout life, at times better, at times worse.

Treatment.—Mechanical contrivances intended to procure rest to the fingers, and to allow the act of writing more with the arm than with the hand, generally prove useful only for a very short time, sometimes not longer than for a day or two; and after their use the suffering is generally more severe than it was before. Local applications of liniments, embrocations, and ointments, whatever be their ingredients; hot, tepid, and cold local and general baths; gymnastic exercises; sea and mineral water, and carbonic acid baths—all have been tried and found wanting.

The first step in the treatment is entire rest or change of occupation. If it is caused by writing, recourse to a typewriter for correspondence will, in many cases, give relief. Many cases can be cured by writing from the upper arm and shoulder instead of confining the movement to the fingers and hand. Others will be benefited by using a large penholder of rubber or cork, or by learning to write with the opposite hand. Rubbing and a combination of rubbing and kneading that is called massage often gives considerable relief from the discomfort, and sometimes lessens the tendency to spasms.

Electricity will prove beneficial in the majority of cases. The faradic current may be used when the affection is paralytic, but the galvanic current is usually more efficacious. Galvanization of the cervical portion of the cord is far superior to any other method of using electricity. Place the positive pole on the upper cervical vertebræ and the negative in the stylo-mastoid fossa. The current should be allowed to act from five to ten minutes at a time, and be applied to both sides, if the left hand is also suffering. Peripheral galvanization of the nerves and muscles of the affected arm will also prove beneficial. Relatively weak currents should always be employed, in order to avoid exhaustion of the motor apparatus. Static sparks to the cervical region of the cord and to the affected limb often gives immediate, temporary relief.

Tetanus.

This is a disease of the nervous system of microbic origin, caused by the toxic material produced by a specific bacillus, and characterized by persistent, rigid contractions of the voluntary muscles, particularly those of the jaws and trunk. When the jaws alone are involved, it is called lock-jaw or trismus. It occurs more frequently in males than in females; also more frequently in the adult period of life. It rarely ever occurs under five, although it is met with occasionally in newly born children (tetanus neonatorum). Dark-skinned races are more prone to the disease than the white races, even when both are exposed to the same influence. Dampness or cold and extremes of temperature are more favorable to its development. The puerperal state is also favorable for its development. Certain localities are affected with the disease more than others. Injuries, punctured or lacerated wounds, compound fractures, or an abrasion of the skin are liable to be followed by tetanus; quite a common cause is running a rusty nail into the bottom of the foot. It may follow immediately (within twelve hours) after a wound, or it may develop after a lapse of several days or weeks. Robinson reports a case in which death resulted within fifteen minutes after the time of the injury. (?)

Symptoms.—The first symptom that is noticed is generally a stiffness or rigidity of the muscles of the jaw and neck, as ordinarily these are the first affected. At first the stiffness may be only of sufficient degree to slightly interfere with turning the head, swallowing, or a slight difficulty in opening the mouth. The patient attributes this to having caught "cold." This increases until it becomes difficult or impossible to separate the jaws (whence the common name "lock-jaw"), and there is also an increasing stiffness of the neck, and the head is bent backward.

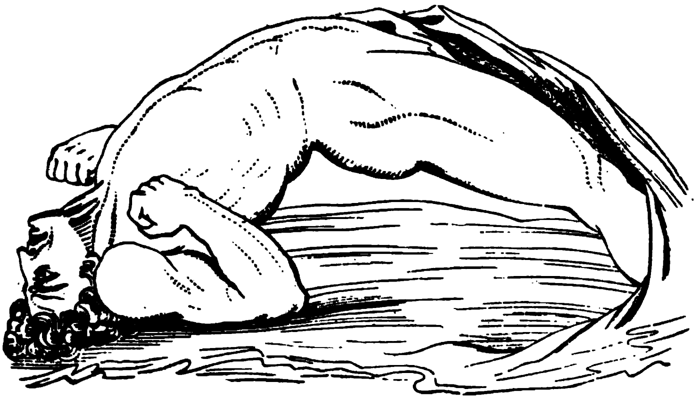


FIG. 65.—A MARKED PAROXYSM OF TETANUS. (After a drawing by Sir Charles Bell.)

The spinal muscles next become affected, and the vertebral column is bent back, inducing the condition of "opisthotonos." The legs may become stiff and extended; the arms are but little affected. The respiratory muscles may become involved, the thorax becomes fixed, the glottis closed, and the patient dies within a few minutes from suffocation. The facial muscles are last affected; the angles of the mouth are drawn outward and downward, the upper lip is pressed against the teeth; the countenance assumes a ghastly grin—the so called "*risus sardonicus.*"

When the disease is fully developed, during a paroxysm the head is drawn back, the spine is arched, the legs rigid, and the feet extended, so that the patient in a severe paroxysm may rest on the head and heels. These paroxysms are accompanied by intense pain, and recur with increased severity and frequency as the disease advances. During sleep the spasms are generally absent, but in severe cases the patient is unable to obtain sleep or to quench his thirst or hunger; the spasm continuing for days without intermission. With these symptoms there is usually rigidity of the muscles of the abdomen, and a distressing pain at the pit of the stomach, dependent upon spasm of the diaphragm. Consciousness is never affected at any time throughout the course of the disease. The pulse is rapid and small; the temperature varies greatly, ranging from normal to 102° to 103°, and even as high as 108° to 110°. The urine is scanty and high colored, and there is usually constipation. In cases that recover the paroxysms or spasms become lighter and less frequent, and finally cease.

Diagnosis.—The character of the spasm, the stiffness or complete fixation of the jaws, the difficulty in swallowing, the facial expression, the opisthotonos, together with the history of the case.

Prognosis.—Prognosis, as a rule, is unfavorable; death occurring during a paroxysm, either from failure of the heart or from asphyxia in consequence of the prolonged arrest of respiration. In cases that continue for a week or more the prognosis is more favorable. The prognosis is more favorable in cases in which the disease is not developed for ten days or two weeks. Usually, when the symptoms last for fourteen days, recovery is the rule.

Treatment.—The patient should be kept perfectly quiet and the room darkened. Liquid nourishment alone should be given; this may be introduced by means of a tube passed behind the last molar, or, as sometimes happens, there is space between the teeth through which the tube can be introduced. In other cases it may be necessary to introduce a tube (a soft catheter may often suffice) through the nostril into the stomach. It is best not to remove a tooth, as has been sometimes recommended, and thereby avoid causing a fresh irritation of the peripheral nerves. Other cases may be nourished per rectum. In cases due to injury surgical measures have proven beneficial, such as incisions, or deep cauterization of the wound, or later of the cicatrix; also nerve-stretching or an excision of the nerve. Local application of ice-bags or hot-water-bags to the spine will often prove beneficial.

Aconite.—Great fear and anxiety of mind, with great nervous excitability; tingling and numbness; fever; tension of the muscles; trismus; stiffness of the limbs and even opisthotonos. Especially indicated when the disease follows an injury.

Belladonna.—Stiffness of the jaws, difficult deglutition; eyes wild and unsteady, pupils dilated; twitching and convulsive movements; overexcitability of all the senses; a jar or touch bringing on a spasm. In cases where the wound is suppurating or has suddenly ceased to discharge and there are drawing and stiffness in the neck and spine, spasmodic contraction in tongue, contortion of eyes, extension of extremities, violent distortion of all extremities, aggravated by the slightest contact, give belladonna.

Angustura.—Trismus; drawing, tension and stiffness of the back; painful stiffness in the neck and between the shoulder-blades; twitching and jerking along the back like electric shocks; spasmodic twitching; tetanic spasm caused by contact and noise; thirst without desire to drink.

Hydrocyanic acid.—Persistent, tonic spasm; tetanic spasm with lock-jaw; risus sardonicus and embarrassed respiration with bluish-red color of face, and frothing at the mouth; the body is stiffened and thrown back; cramp in the nape of the neck; protrusion and glistening of the eyes; immobility and dilatation of the pupils. Hydrocyanic acid seems to have a special affinity for the upper part of the body, especially for the muscles of the jaw, face, and upper portion of the back.

Lachesis.—When with trismus and spasm of the larynx, there is blueness from asphyxia, and the patient sleeps into the paroxysm; anxious and painful expression; blue circles around the eyes; convulsion and distortion of the face; lock-jaw;

stretching of the body backward; screaming; feet cold and itching.

Strychnia.—Strychnia affects the nervous system, especially the spinal cord. Violent tetanic spasms; alternate trismus and opisthotonos; violent convulsions, all the muscles become suddenly stiff, the jaws clenched, eyes distorted and staring wide open; dyspnœa, from drawing in of the muscles of the chest; a feeling of restlessness, accompanied by trembling of the limbs and some stiffness of the neck and jaws; constriction of the chest and throat; shooting pains like electric shocks in the back, down the arms, and legs; violent opisthotonos; the body is bent backward and rests upon the head and heels, the hands are clenched, the abdominal muscles hard and tense, the respiratory muscles fixed, the face becomes blue and cyanosed. The corners of the mouth are often drawn up so as to produce a ghastly grin—the "risus sardonicus." The convulsions are excited by an impression made on the special senses; a slight touch often being enough to bring on a violent spasm.

Physostigma.—Increased irritability of the sensory nerves; twitching and trembling of the muscles, followed by paralysis; tetanic spasm of the involuntary muscles; constriction of the throat; severe pain and cramp in the stomach and bowels; stiffness of the spine and legs; the pupils are dilated during the spasm and contracted during the interval.

Cicuta virosa.—Trismus; tetanic rigidity from injuries; sudden rigidity, then jerks and violent distortion, followed by utter prostration; spasms of the muscles, especially of neck and chest; great oppression of breathing; face dark red; or face cold and pale; hands cold; lock-jaw; froth at the mouth; pulse weak, slow, and trembling; loss of consciousness.

Camphor.—(Preferably the mono-bromide 2x trit.) Camphor is indicated in tetanic spasms with the *ever present deathly coldness;* coldness all over the body; cold perspiration, often clammy; sudden and great sinking of strength; oppressed anxious breathing; limbs extended and fixed, lower jaw rigid and wide open; lips drawn inward, and great distortion of the facial muscles; showing of the teeth from drawing up of the corners of the mouth.

Niconitum.—Farrington gives the following indications for the use of this drug: Head drawn back, with rigidity of muscles of the head and back; contraction of eyelids and masseter muscles, hissing respiration, from spasm of the laryngeal and bronchial muscles; alternate tonic and clonic spasm, followed by general relaxation and trembling; retraction of the abdominal muscles; intense pain in bowels, nausea, cold sweat, and speedy collapse, with asphyxia.

Opium.—Twitching of the lips and facial muscles, with distortion of the mouth; lock-jaw; irregular and difficult breathing; spasm begins with loud screams; then foam at the mouth; flushing of the face; eyes half opened and upturned; pupils large and insensible to light; tetanic spasm with opisthotonos; rigidity of the whole body, the trunk curved in the form of an arch; after the attack, deep sleep, face remains deep red, and hot; stupor between spasms.

Hypericum.—Tetanus of the neck and jaw, worse on the right side, involving the thorax and abdomen; tetanus the result of penetrating wounds. In a general way hypericum is indicated for the effects following injuries of nerves.

DISEASES OF THE BRAIN AND ITS MEMBRANES.

Mengingitis.

(*Inflammation of the Membranes of the Brain.*)

The membranes of the brain are subject to inflammation, which may be confined to one membrane, or, beginning in one membrane, extend to the others, and even to the brain *(meningo-encephalitis)*.

When the dura mater is affected, it is termed "pachymeningitis externa" or "interna," according as to whether the inflammation affects the outer or the inner surface of the membrane. When the inflammation affects the pia mater and arachnoid, it is termed "leptomeningitis."

Pachymeningitis.

(*Inflammation of the Dura Mater.*)

This may involve the external layers of the membrane (*pachymeningitis externa*), or the internal layers (*pachymeningitis interna*). It may be acute or chronic. It is usually circumscribed, and rarely ever spreads over the whole convexity of the brain. The tissues of the substance of the dura mater may be involved to a greater or less degree, but the chief lesions are upon the internal or external surfaces.

Acute pachymeningitis externa is almost always secondary to injuries or diseases of the cranial bones; thus fracture of the skull, either depressed or not, causing an effusion of blood between the bone and dura mater, ostitis, syphilitic caries, suppurative inflammation of the internal and middle ear or mastoid cells may all act as causes to produce it. Erysipelas of the scalp or face may extend to the membranes of the brain and set up an inflammation.

The inflammation is usually suppurative in character, and the pus may accumulate between the membrane and the bones or in the substance of the membrane. The inflammation may extend to the inner surface of the dura mater, to the pia mater and brain, or it may remain localized and undergo resolution.

The symptoms of the external variety are usually secondary to, and lost in, those of its cause. In many cases the symptoms are very obscure, but when distinct symptoms do exist, they are manifested by vertigo, headache, delirium, and sometimes convulsions and coma. Localized pain over the seat of the disease, increased by percussion, is the chief diagnostic symptom. Paralysis of the opposite limb may result from a collection of pus compressing the motor region of the cortex. Rarely is there any elevation of temperature.

The treatment is directed mainly to the disease which causes the inflammation. In addition to that, the treatment given for meningitis proper is, in the main, applicable to this form. If, however, there are symptoms of pus-formation, as indicated by chill, rigor, etc., it should be evacuated by trephining.

Chronic pachymeningitis externa consists in the formation of new connective tissue in the dura mater, by which it becomes thicker, and, in many cases, adherent to the bones of the skull. This thickening may be general or circumscribed, and may involve the entire thickness of the membrane.

Pachymeningitis interna may be secondary to inflammation of the external surface, or it may occur as a complication in pyæmia, puerperal fever, chronic diffuse nephritis, chronic alcoholism, acute blood diseases, such as rheumatism, small-pox, erysipelas, or it may occur idiopathically. It occurs more frequently in males; also in extreme old age. " It is met with quite frequently in general paralysis of the insane." (Gowers.) There are two forms of pachymeningitis interna: The purulent and the hemorrhagic.

Purulent internal pachymeningitis (acute) is a form of inflammation the symptoms and treatment of which are similar to those of purulent inflammation of the pia mater, which is described under the heading of " Leptomeningitis."

Hemorrhagic internal pachymeningitis (*chronic*) is an affection which is commonly known as hematoma of the dura mater or meningeal blood-tumor. It is a rare affection, and is characterized by the formation of layers of new delicate connective tissue with numerous very thin-walled blood-vessels. These vessels are liable to rupture, giving rise to extensive hemorrhages, either into the substance of the membrane or between it and the pia mater. " Sometimes masses of new tissue and blood, from half an inch to an inch or more in thickness, are in this way formed, greatly compressing the brain."* These new membranes are most frequently formed over the convexity of the brain, but may extend over nearly the entire surface of the dura mater.

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* Delafield and Prudden, " Hand-Book of Pathological Anatomy and Histology."

There are no positive symptoms of this condition. It is only when headache, limited to the vertex or temporal regions, nausea, vomiting, convulsions, twitchings, and partial hemiplegia occur in connection with certain diseases that are known to produce this affection, such as chronic alcoholism, general paralysis of the insane, infectious diseases, etc., that we are led to suspect that this disease exists. In many cases this condition has existed and not even been suspected during the patient's life, being discovered only at the *post-mortem.*

The treatment is similar to and is described under the heading of " Cerebral Hemorrhage."

Leptomeningitis.

(*Meningitis Proper, Inflammation of the Pia Mater and Arachnoid.*)

This is the form which is commonly meant when cerebral meningitis is spoken of, and will be described under " Acute Meningitis."

Acute Meningitis.

By acute cerebral meningitis is understood inflammation of the pia mater and arachnoid. It may be either simple or purulent—that is, there may be a large effusion of serum or an extensive formation of pus.

Ætiology.—It occurs more frequently in children than in adults, and is more frequent in males than in females. Exposure to cold, excessive heat, abuse of alcoholic liquors, or acute specific diseases, as measles, scarlet fever, small-pox, typhoid fever, and rheumatism, may all be causative factors. In pneumonia and the acute specific diseases the inflammation may be either simple or purulent. " Meningitis has a special relation to pneumonia." (Gowers.) Other causes are injuries to the head from falls and blows of various kinds, causing laceration, hemorrhage, or concussion of the membranes; extension of inflammation from the eyes or nose; erysipelas of the scalp or face; ulcerative endocarditis; septicæmia from puerperal fever; syphilis.* The most frequent cause of the purulent form is an extension of the inflammation from ear disease. Meningitis may occur idiopathically.

Symptoms.—The onset may be gradual and insidious; a feeling of languor, lassitude, mental irritation, persistent vomiting; or it may be rapid, a chill followed by high fever, temperature running up to 103° to 106°, pulse 120 to 160, quick and hard. The temperature may be high in the earlier stages and later fall below normal. In very rare cases it may run its course without fever. (In acute meningitis originating from otitis media or from infective wounds the pulse is quick and small.) The eyes are bright, the pupils contracted and painfully sensitive to light, in the earlier stages, but dilated in the later stages; eyeballs injected. Headache, intermittent to some extent, is always present; it may be diffused or confined to a limited part of the head, but is most frequently located in the frontal region. This is one of the chief symptoms, and is usually very intense from the beginning until the patient becomes unconscious. Delirium is generally present from the first, and is often of furious character. It sometimes becomes so active that it resembles acute mania. The patient may have to be held in bed, fights and struggles with the attendants; hallucinations of sight and hearing often accompany the delirium and the articulation of the patient frequently becomes incoherent, or there may be periods of violence alternating with stupor; in other cases, however, the delirium is of a mild nature—a continuous, low, muttering delirium. There is hyperæsthesia of the special senses; hearing becomes morbidly acute; loud noises cause great agony, and even slight sounds are unbearable, and there is intolerance to light. The general sensibility is also increased. Drawing a dull point along the skin causes a red line to appear (tache cerebrale). There may be twitching of the muscles of the face or of the limbs, or there may be convulsions. Strabismus and hemiplegia are met with frequently in these cases. Retraction of the head is an almost invariable symptom in the severer forms. The tongue is usually thickly furred and the breath very offensive. The bowels are usually obstinately constipated and the abdomen retracted. In the later stages the Cheyne-Stokes respiration may be developed, and is always of fatal significance.

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* With the progressing accumulation of clinical and pathological material, *syphilitic* meningitis is now known to differ in no essential respect from *ordinary* meningitis, except in those rarer instances where the specific gummatous character prevails.

Diagnosis.—The persistent and intense headache, vomiting, muscular twitching; the history of a possible cause of meningitis, will be indicative of this affection. The diagnosis from typhoid fever may sometimes be extremely difficult, unless sufficient time has elapsed to mark the variations of temperature, or unless the cutaneous or enteric symptoms manifest themselves. Pneumonia of the apex may often be wrongly diagnosed as meningitis; in this affection there may be intense delirium, nocturnal cries, retraction of the head, patient fighting and struggling with attendant, all of which resemble an acute attack of meningitis. It is only by careful auscultation of the lungs that the question can be decided.

Another affection which has often been wrongly diagnosed as meningitis is *delirium grave.* The symptoms of this affection are manifested generally by wild furious delirium, insomnia, grinding of the teeth, strabismus, contraction of the pupils, and convulsive movements. But this affection is followed by remissions, which leave the patient in extreme mental and physical depression. Recovery from this affection is rare. Acute meningitis is with great difficulty, however, distinguished from *tubercular* and *cerebro-spinal* meningitis.

Prognosis.—Prognosis is extremely grave, although many cases recover.

Treatment.—Compare "Cerebro-Spinal Meningitis."

Cerebro-Spinal Meningitis.

(*Acute Cerebro-Spinal Meningitis, Spotted Fever, Cerebro-Spinal Fever.*)

This is a violent inflammatory affection of the membranes of the brain and spinal cord, which is slightly contagious and appears epidemically, although sporadic cases may occur occasionally.

Ætiology.—It is produced by a special micro-organism. It occurs more frequently in winter than in spring. No age is exempt, but children under ten suffer much more frequently than others. Bad sanitary conditions, insufficient food, crowding of large numbers of persons together, as in soldiers' barracks, tenement-houses, or on board ship, are all causes which predispose to cerebro-spinal meningitis.

Symptoms.—The symptoms usually come on suddenly and with violence from the start, although in rare cases there may be prodromal symptoms for a few hours or days, such as lassitude and chilliness, succeeded by headache, by tenderness at the nape of the neck, by nausea, and by pain in the back and joints, preceding its full development. Generally, however, its onset is sudden; a violent chill is quickly followed by intense headache, vomiting, and extreme prostration. A violent occipital and cervical pain is one of the most prominent and distressing symptoms. This pain may remit, but does not cease during the attack. Associated with the headache is vertigo and intolerance of light and sound. The pupils are generally dilated. There is usually persistent irritability of the stomach, with great thirst and spasmodic contraction or convulsive movements in the muscles of the extremities. The pulse is variable; first it may be normal or subnormal; later on it ranges between 110 and 120 or 160, and is irregular; its remarkable variation as to frequency and tension is almost characteristic. The temperature is usually high, 104° to 106°. In many cases there is delirium, which quickly passes into somnolence and stupor.

Another symptom of the fully developed disease is a rigid contraction of the muscles of the posterior cervical region, thus causing the head to be firmly drawn backward. It appears mostly between the second and fifth days, and lingers far into convalescence. It varies greatly in degree, from a slight stiffness, noticeable only when attempting to flex the head, to a contraction so great that the vertex is drawn down between the shoulders, at almost right angles with the spine. In the worst cases swallowing is rendered extremely difficult and painful. The contraction of the muscles may extend along the spine, which frequently is painful, not specially to the touch, but on movement of any kind. This rigid contraction may be so extensive that if the patient be placed on his back in bed he would only touch the bed at two points of the person—the back of the head and the hips (opisthotonos). The face is pale, or cyanotic, and has a fixed or suffering expression. The skin may be either dry or perspiring, and is usually very sensitive. On account of red, purplish, mottled blotches on the skin, it was formerly called spotted fever. These eruptions may be of the nature of erythema, herpes, or purpura. The purple spots are the most frequent, and may be seen from the start, and occasionally so large as to be an inch or more in size. Herpes may make its appearance within three or four days. Sometimes the eruptions look like millet-seed under the skin, and when so, the eruption is said to be miliary. The bowels are at the outset constipated, but as the disease advances they become relaxed.

All the symptoms develop rapidly, and reach their full intensity from the third to the sixth day. After the disease has lasted for some time, the patient may pass into that condition termed " the typhoid state "; a condition usually marked by stupor or remitting delirium, a dry cracked tongue, sordes on the lips and teeth, a small rapid pulse, and involuntary evacuations.

Diagnosis.—The sudden onset of the disease; the severe headache, especially at the base of the brain; the early appearance of delirium; the retraction of the head, together with the fact of an epidemic being prevalent.

Prognosis.—Except in very mild cases, it is unfavorable. Death may ensue within twelve hours from the beginning of the attack. The average duration in fatal cases is two to four days. Other cases may assume a chronic form and continue two to three weeks. The average duration of cases that recover is about two weeks. If coma comes on before the fifth day, it is usually of fatal significance.

Many cases recover without either mental or physical impairment, but the greater majority of cases are followed by very serious sequelæ, the more important being deafness, blindness, speech defects, paralysis, spinal irritation, or chronic spinal meningitis, weakness of memory, and chronic hydrocephalus.

In favorable cases the symptoms of depression are less marked and of shorter duration. Early in the disease the vomiting ceases, the back and head pains subside, the rigidity disappears, the strength slowly returns, and the patient enters upon a gradual although a somewhat protracted convalescence.

TREATMENT OF ACUTE CEREBRAL MENINGITIS AND CEREBRO-SPINAL MENINGITIS.

Seemingly it would appear that the different varieties of meningitis should be treated separately, but, so far as our knowledge at present goes, the symptoms of inflammation in these different membranes, as well as the treatment which they require, are so much alike that it is useless to discriminate between them. It is true that the inflammation may exist separately in the different meninges, but the cases are rare in which any considerable proportion of one of these structures is affected without the other; also, in the main, the same treatment would be called for in cerebro-spinal meningitis as in purely cerebral meningitis, for the spinal type also implicates the membranes of the brain.

If the meningitis is due to an extension of inflammation from some local disease, as ear troubles, or erysipelas of the scalp or face, treatment of that affection is of the first importance. In the suppurative variety a free exit should always be made for any collection of pus in the neighborhood of the skull. All sources of irritation should be removed, if possible. In children especially should the gums, teeth, ears, and prepuce be thoroughly examined for any source of irritation. Rest and quiet are important factors in the treatment of meningitis. The room should be darkened and all loud sounds or noises prohibited as much as possible. In cases where the temperature is extremely high, cloths rung out of tepid water and applied to the head and nape of the neck will often reduce the temperature and lessen the headache.

The head douche will often be of service in the treatment of severe cases of meningitis. Edmonds gives the following instructions in regard to its use: Should the skin be warm or hot and perspirable, let the water be warm. Should the skin be hot and dry, let it be cold, cool, or tepid. It should fall in a continuous stream from a pitcher at a distance from two to four feet onto the back of the head, the frontal region of the head resting in the hand of an assistant, with a tub below to catch the water as it falls from the head. The douche should be repeated at intervals of one to two hours until some effect shall have been attained. Each application should continue for about two minutes. The advantage in the douche seems to consist mainly in the rapid absorption of heat during evaporation. There seems in some way to be an advantage gained in the fall of the current from a considerable height in a continuous stream on the back of the head, over and above any process of wet cloths or applications of water by sponging.

Aconite.—In the very onset aconite will claim our attention as one of our best remedies in serous inflammations. It is indicated where there is great heat with full strong pulse and dry skin; eyes red and inflamed; pupils contracted; lancinating pains in and through the whole head; pulse rapid, 120 to 130; great restlessness and uneasiness.

Belladonna.—The specific action of belladonna is on the cerebral system, which is the point from which all its symptoms radiate, as from a center, in all diseases. Belladonna is the chief remedy in the first stage of the inflammation, before effusion takes place. After the stage of effusion takes place it is worthless. Belladonna is usually followed by bryonia or apis, according to indications. Belladonna is indicated where there is violent congestion to the head; face flushed or alternately red or pale; violent throbbing of the carotids; furious delirium; eyes red, glistening, and sparkling; wild and unsteady look; pupils dilated; sensitiveness to light and noise; vertigo on sitting up, and on turning over in bed. The child starts from a heavy, drowsy sleep, cries out, grinds the teeth and awakens frightened; twitches of the muscles, jerking of the limbs or even convulsions; sharp, shooting pains in the head; boring the head into the pillow; the head is thrown backward, and there is rolling of the head from side to side; *sleepy but cannot sleep.* The child lies in a drowsy, comatose state, from which it starts suddenly, cries out, but is never fully aroused.

Glonoine.—Intense headache with a sense of expansion; the brain feels too large for the skull. Throbbing headache with a rapid pulse; light before the eyes; redness of the eyes with soreness of the globe of the eyes; singing and buzzing in the ears. Headache with violent vertigo, nausea, and vomiting; headache aggravated by shaking the head; seems as if the head would fly to pieces; flashes of light before the eyes; pupils dilated; eyes rolled upward.

Veratrum vir.—In the first and active stage of meningitis the congestion is so great that the patient is delirious and often insensible; intense cerebral congestion with vomiting; severe frontal headache with vomiting; fullness and sense of weight in the head; headache proceeding from the nape of the neck; face flushed or purple; throbbing of the carotids; ringing in the ears; rolling of the eyes and head; sudden spasm with vomiting, followed by *great* prostration; head full, slow pulse, with marked opisthotonos; sudden spasms from congestion of blood of the head; convulsive twitching of the muscles of the face and jerking of the limbs, indicating that the child is on the verge of spasms. But the chief characteristics of veratrum vir. are *great rapidity* of the pulse and a tendency to convulsions. Of all the remedies in acute meningitis I trust none with so much confidence as veratrum vir. It should be given low (10 drops in a half glass of water and give a teaspoonful for a dose) and repeat the dose every twenty or thirty minutes until some appreciable impression shall have been made upon the pulse, and then gradually increase the intervals.

Hyoscyamus.—In many respects this remedy resembles belladonna. Fullness and heat of the head; flushing of the face; stupid expression, injection of the eyes; pupils dilated; sight blurred or total blindness; vertigo; wild delirium, which gradually passes into stupor and coma; muttering, with picking at the bed clothes; constant delirium, with great restlessness; jumping out of bed; singing, muttering, smiling; stool and urine pass involuntarily; hiccough, putrid breath; sordes on the teeth; lower jaw dropped and the patient lies quietly, with an occasional twitching of groups of muscles; patient greatly prostrated; headache relieved by shaking the head; pulsating waves through the head; grating of the teeth; sudden starting during sleep; great nervousness with twitches of the muscles; clean, parched, dry tongue; great thirst.

Stramonium.—Furious delirium; loquacious delirium; tries to escape; screams; frightful visions; great restlessness; wide open staring eyes; transient loss of sight, hearing, and speech; strabismus; double vision; excessive dryness of the mouth; tongue coated yellowish brown; or dry and swollen; violent thirst for sour drink; the spine and cervical region very sensitive to pressure; drawing pains in the small of the back; twitching of the hands and feet; strong smell like carrion; involuntary urination.

Gelsemium.—Dull, stupefying headache commencing in the occiput and spreading over the whole head, or to the forehead and eyeballs; great heaviness of head; head feels too big, as "big as a bushel"; sensation as of a band drawn tightly around the head, with a feeling of great soreness of the scalp, and a sore bruised feeling of the brain; severe pain in the upper cervical region or extending along the whole spine; vertigo, drowsiness, and great muscular prostration; stupor of the mental faculties, and wild, incoherent delirium; tongue coated yellowish-white; tongue feels thick, and can hardly speak; coldness of the hands and feet. Gelsemium in a low dilution will often control the spasms when all else fails.

Bryonia.—Bryonia is indicated when the stage of excitement is merging into that of stupor or depression. It follows belladonna and is indicated after effusion has taken place. The patient becomes more stupid from increased pressure on the brain. The fever is generally lower than the veratrum and belladonna stage. It is indicated where there is mild delirium; great pain in the occiput; headache worse from motion and on opening the eyes; worse on the right side; pressive pain in the back of the head, extending down the neck; stiffness of the neck; pain in the back and limbs as if bruised; vertigo upon sitting up in bed; if the child is moved it screams with pain; there is more or less motion of the jaws as if chewing something; face dark red, livid; great heat about the head, with dry burning heat all over body; or a pale, cold, moist skin, cold sweat upon forehead; the face suddenly flushes up and then pales off; the child is stupid; the abdomen distended; the tongue thickly coated white or else dry and brownish; the lips parched; great thirst for large quantities of water; when offered drink takes it hastily and impatiently; dim and glassy eyes, slow, irregular pulse; dysuria; constipation. Bryonia is especially indicated where the meningitis follows the suppression of some eruption, as that of scarlatina or measles.

Apis.—Apis follows belladonna. Belladonna is often given when apis is more suited to the case. It is indicated after effusion has taken place. The symptoms of apis all indicate great cerebral irritation: *sudden shrill outcries in sleep;* child lies in a stupor, grinding the teeth, boring of the head in pillow; restlessness; vertigo worse when sitting or when lying down and on closing the eyes; stiffness in the back of the neck; inability to hold up the head; hurried, difficult respiration; pulse variable and intermittent; face swollen, pale, and œdematous; tongue red at the tip, or dry with a brown streak down the middle, sides moist; fiery redness of the buccal cavity; drinks often but little at a time, or no thirst; scanty and suppressed urine; child puts its hands to its head while it screams, even when unconscious; weakness and trembling of the limbs or paralysis.

Helleborus.—Helleborus is one of our most important remedies in the advanced stage of meningitis when the exudation has taken place, and when there is a tendency to oscillate between coma and convulsions. It follows well after apis, when the irritative stage of apis gives place to *mental torpor with want* of reaction; no response to touch or pressure; complete sopor; soporous sleep with sudden screaming and crying out and starting; vertigo; violent pain in the occiput; the pain is so violent that he knows not where or how to rest his head; relieved by keeping quiet with eyes closed; shocks pass through the head like electricity; head drawn back with stiffness of the cervical muscles; boring of the head in pillow; head hot; pupils dilated; forehead wrinkled and covered with cold sweat; face pale and œdematous; constant rubbing of the nose; nostrils dry and dirty; constant chewing motion; rolls the tongue from side to side; a tendency of the lower jaw to drop; automatic motion of one arm and leg; rapid, small, tremulous pulse; difficult breathing; urine dark and scanty; jelly-like mucous stools, with urging tenesmus; hydrocephalus; paralysis more or less complete.

Arsenicum.—Arsenicum is especially suited to the later stage. It is indicated where there is great restlessness; fear and anguish; rapid and great prostration with sudden sinking of the vital forces; constant motion of the head and limbs; intense headache; sensation as if the brain beat against the skull, during motion; constant, severe frontal headache, with vomiting when raising the head; vertigo; ringing in the ears; hardness of hearing; child lies in a stupor with half open eyes; hippocratic countenance, expressing great anguish; face pale and shrunken, a white, waxy appearance; nose cold and pointed; or a pale and hot face, hot skin; tongue dry and red, or dry and brown or black; black leather-like tongue; lips dry and cracked and covered with sordes; drinks often but little at a time; rapid, feeble, and intermitting pulse; difficult breathing with great anguish; urine scanty, difficult, and painful; swelling of the feet and limbs; tonic spasms followed by paralysis.

Veratrum alb.—Sudden sinking of the strength; cold perspiration, especially on the forehead; cold breath; sunken eyes; blue or green circles around the eyes; pinched up bluish nose; cold tongue; grating of the teeth; face collapsed, pale, bluish; red while lying down but becomes pale when rising up; great coldness externally but violent internal heat; pulse feeble, irregular, thread-like; cramps in the calves of the legs; stiffness of the neck and spasms of the limbs; copious rice water stools; violent headache with delirium; rolling of the head from side to side, with short screams; boring the head in the pillow.

Camphor monobromide 2x.—I think no other remedy will compare with the monobromide of camphor 2x for controlling the persistent vomiting of children in brain affections. It is indicated especially where there is *persistent vomiting*; great restlessness; paleness of the face; icy coldness of the whole body; violent cramps in the stomach and limbs; head retracted, spasms and rigidity of the limbs.

Solanum.—Terrific headache as if the head would burst; delirious raving; rage; slow pulse; contracted pupils; neck feels stiff and sore as if bruised; stiffness and convulsions, excited by the least touch; violent subsultus tendinum; tetanic rigidity of the whole body.

Opium.—Great drowsiness; profound stupor, with stertorous breathing; coma, patient can hardly be aroused from the stupor; when aroused immediately relapses again into a state of insensibility; dark-red bloated face; eyes fixed and half closed; pupils contracted or dilated; pulse variable, small, quick, irregular, or full, slow pulse; great thirst, mouth dry, tongue coated white; abdomen hard and distended and sensitive to the touch; urine suppressed; constipation, stools composed of hard, round, black balls.

Cuprum.—No remedy excels cuprum and very few equal it, where the spasm is ushered in by a violent shriek or cry, frothing at the mouth, and the convulsions followed by a deep sleep; violent delirium or a loquacious delirium; great restlessness, anguish, afraid of falling, clings tightly to the nurse; face pale or a blueness of the face and lips; coldness all over the body; eyeballs constantly rotating; deep sunken eyes, with blue rings around them; spasmodic distortions of the face; coldness of the hands, with bluish appearance of the fingers; thumbs clenched tightly in the palms of the hands; stupor, twitching and jerking of the limbs. Indicated especially after suppressed eruptions, as scarlatina, measles, erysipelas, etc., and in teething children.

Lachesis.—Lachesis is indicated more especially where there are indications of blood poisoning or impending paralysis; sharp, stitching pains which seem to concentrate at the root of the nose; or the pains pass from the zygoma to the ear (characteristic); the pains extend from the head to the neck and shoulders; child screams out or bores head in pillow; head hot; face flushed; feet cold; tongue dry, red, or black, or a strawberry tongue; pulse quick and feeble.

Rhus tox.—Violent headache; fullness and bruised pain in the head extending to the ears, and aching in the occiput; vertigo when rising from bed; hemorrhage from the ears and nose; thirst for cold water or milk; red, dry, cracked tongue, or a tongue with a red triangular tip; pain in the shoulders and back, with stiffness of the muscles and joints; pulse rapid, irregular, weak, and intermittent; cramps, numbness, and paralysis.

Oxalic acid.—Intense inflammatory pain through the back; stiffness of the limbs with paroxysms of spasmodic dyspnœa. The weakness about the hips and loins extends down the legs with numbness in the back. Terrible neuralgic pains in the spermatic cords, worse from the slightest motion. Aggravation of all pains or ailments when thinking of them.

Sulphur.—Sulphur is the king of remedies, around which centers the whole Materia Medica. Its great sphere of usefulness is in cases where there is defective reaction; in cases where the system refuses to respond to the indicated remedy. A few doses of sulphur will often clear up the case and bring about reaction, and either itself cure the case or pave the way for another drug which will cure. It is indicated in children where there is defective assimilation, the appetite may be pretty good, yet but little nourishment is obtained from the food; also in children of a tubercular diathesis and in tubercular meningitis; not in the last stages but just in the commencement of the effusion; when there are violent convulsions; sudden flushing of the face; pupils dilated; heaviness, fullness, and pressure in the forehead; pain as if the brain were beating against the skull; the child cannot hold its head up; cries out in its sleep; drawing pain in the nape of the neck; sweat on the head of a musk-like odor; sour smelling breath; jerking of one or both legs when falling to sleep; turbid urine with red sediment. With sulphur the child does not sleep at all, or it starts up from sleep suddenly with a cry, or sleeps in cat-naps; the face is pale and bathed in a cold sweat, particularly the forehead; the eyes are half open; the pupils react very sluggishly to light; the urine is suppressed; there is occasional twitching of one or the other limb. There is no remedy which can take its place when these conditions are met with, and you will find it acts like a charm.

Zincum.—Zincum is a valuable remedy in the later stages of acute meningitis and hydrocephalus. It is indicated in cases where convalescence is slow; weakness of memory; stinging pains in the head; pressing, tearing pains at the base of the brain which shoot through the eyes and into the teeth; stiffness and pain in the cervical and upper dorsal regions; bruised pain in the small of the back; child cries out in sleep; when awakened, excessive fear; rolls its head from side to side; excessive and violent vertigo, with nausea and faintness; face pale with much emaciation; flushes of heat in face and head; coldness of body; profuse perspiration; ravenous hunger; tongue dry, feels heavy; lids dry and cracked; urine scanty, turbid as if mixed with clay; passes urine with great difficulty; stools dry, hard, and great difficulty in passing them; obstinate constipation; twitching and jerking through the whole body during sleep; drawing pains in the limbs; cannot keep the feet still; muscles trembling; twitching in the hands and feet. This remedy is of special value where there is great exhaustion of nerve force.

Chronic Meningitis.

This variety of meningitis may be confined to the convexity of the cerebrum, or to the base of the brain (basilar meningitis); or to circumscribed patches of the membrane. The pia mater is thickened and opaque, the thickening being sometimes very considerable. There is a formation of new connective tissue, and a production of pus, fibrin, and serum.

Chronic cerebral meningitis may be the sequel of acute cerebral meningitis, or may be caused by trauma, alcoholism, or syphilis. When due to alcoholism, the disease usually affects the convexity over both hemispheres. Chronic syphilitic meningitis is usually local, but may affect either the base or the convexity of the brain.

Symptoms.—The symptoms will vary according to the seat of the disease. When the lesion affects the base of the brain, the cranial nerves are liable to become involved. Headache is a prominent symptom, and may be mild in degree, or may be remarkable both for its intensity and its obstinacy. The pain is generally felt in the forehead, in one or both eyes, or may be located in the vertex or occiput, and is aggravated by mental exertion, by muscular effort, or by a dependent position of the head. Vertigo is another marked symptom, and may be so intense and persistent as to prevent the patient from walking without support. There is sometimes slight delirium; also a slight optic neuritis is sometimes observed. There may be defective vision, or the hearing may become impaired or lost. In many cases mental failure is well marked. But the chief symptom is paralysis of certain muscles or groups of muscles. The paralysis may be limited to the hand, arm, facial muscles, or tongue, but in the greater majority of cases the eye muscles are the first ones affected, causing strabismus. In other cases paralysis of the whole of one side of the body (hemiplegia) may ensue. The paralysis may be preceded by an attack epileptiform in character. Anæsthesia may be present, either general or local, or there may be neuralgic pains in various parts of the body, sometimes of a persistent character. As the disease advances the mental and physical symptoms become more and more pronounced; coma supervenes, during which the patient expires, or death takes place in convulsions.

Prognosis.—The prognosis, as a rule, is unfavorable.

Treatment.—The treatment of chronic meningitis differs in no essential respect from that of the acute form already given under the head of "Acute Meningitis." When there is a history of syphilis, then such remedies as nitric acid, merc. corr., and kali iod. would especially be indicated.

Tubercular Meningitis.

(*Acute Hydrocephalus, Basilar Meningitis.*)

This is a form of meningitis due to the deposit of small tubercles in the pia mater at the base of the brain, accompanied by an inflammatory exudation.

Ætiology.—It is essentially a disease of childhood, occurring between the second and seventh year. Such children usually have a very large head and are more prone to the diseases of childhood. It rarely ever occurs in adult life. It affects male children more than females. In the majority of cases it is the result of hereditary tendencies; in adults, however, it may appear as a complication of pulmonary consumption. Exciting causes may be cold, blows on the head, teething, or eruptive fevers, especially measles; also from the use of tuberculous milk.

Symptoms.—The premonitory symptoms may be vague and not well defined. The child has generally been ailing for some time. It becomes pale, loses flesh rapidly, is peevish, listless, complains of headache. The abdomen is distended and hot—boat-shaped. The bowels are obstinately constipated, but occasionally there is diarrhea, consisting of mucus or mucus mixed with blood. Fever is not continuous, although it is generally present at irregular times of the day. This form of fever is misleading, and is often wrongly diagnosed as malaria. To these symptoms are soon added thirst, a slightly coated tongue, loss of appetite, explosive vomiting without nausea, the vomited matter being usually colorless and watery, a dry feverish skin, an irregular pulse, grinding of the teeth, and contracted pupils; these symptoms constitute the prominent features of the first stage of the affection.

After a longer or shorter period (one to two weeks), the second stage, or, as it is termed, the stage of high irritation or excitement, is reached, and the brain symptoms become more clearly developed. The child shuns the light, puts the hands frequently to its head, and utters now and then a peculiar, sharp, distressing cry (the so called "hydrocephalic cry"). At night the headache becomes worse and is attended with fleeting delirium. Rigidity of the neck and retraction of the head are frequent. The pupils, which were contracted, now begin to dilate irregularly, and respond to light slowly, a slight strabismus is observable, and the eyeballs oscillate. There may be slight twitchings around the mouth or eyelids, or one or more convulsions may occur, followed by paralysis of the facial muscles, or there may be complete hemiplegia. The tongue is usually coated brown or a dirty white; the appetite is lost; and there is unquenchable thirst. The bowels are obstinately constipated and the abdomen is retracted. The pulse is very irregular in its rhythm, sometimes rapid (ranging from 80 to 140 or even 150) and intermitting, then suddenly falling and becoming quite slow. Temperature varies from 102°, 103°, or even higher. Respiration becomes interrupted; a long, sighing respiration. The face is flushed in spots, and the child lies with the eyes half closed, the thumbs resting in the palmar surface of the hand; the child becoming gradually more drowsy and stupid.

The third stage is one of complete stupor, accompanied or preceded by convulsions. The pulse is small, rapid, and intermittent. The temperature rises higher. The face is pale and sunken, with occasional flushes. The eyes are half closed, the cornea dim and blurred; pupils dilated; a cold clammy perspiration. The coma gradually increases, and the patient may die with an accumulation of mucus in the chest during the coma, or the child may die in convulsions. Death is usually preceded by the Cheyne-Stokes respiration. The disease usually runs its course in from two to four weeks.

Prognosis.—The prognosis is unfavorable; recovery is rare; however, there are instances of recovery in which there was a strong presumption that the inflammation was tubercular.

Diagnosis.—When there is no history of tuberculosis personally in the individual, and when the hereditary history is not pronounced, the diagnosis between tubercular and simple meningitis is difficult, and in many cases may be impossible. In tubercular meningitis the beginning is much more insidious, and the course much more protracted; the variation in the pulse, the irregular breathing, and in the majority of the cases the history of the tubercular taint, are diagnostic of this affection.

Treatment.—The treatment of this disease is mainly hygienic and preventive, rather than curative. The object should be, as far as possible, to prevent the development of the disease. Such children should have plenty of fresh air (kept in the country if possible); the diet should be judiciously selected. Remedies should be given, not so much with the expectation of curing the patient as of easing the suffering, though they sometimes do arrest the disease if given early.

The remedies most frequently indicated are apis, bryonia, helleborus, arsenicum, veratrum album, cuprum, and sulphur; for the indications of these remedies, see " Acute Meningitis." Belladonna is rarely indicated in tubercular meningitis; it is often given, however, when apis should have been, and would have proven more serviceable. In addition to these remedies, calcarea carb., silica, hepar sulphur, kali iod., and spongia will often render valuable service.

Calcarea carb.—Children with dry, flabby skin, large open fontanels, profuse perspiration of the head, which wets the pillow for quite a space around the head when sleeping; fair and pale children; lively, precocious, large headed children; the head is disproportionately large to the rest of the body; the abdomen is abnormally large (pot-bellied children); the feet are usually cold and clammy; dentition is slow. It is indicated in the early stage where you find the child with a hot head, flushed face, starting in sleep and screaming out unexpectedly or without cause, and convulsions persist.

Silica.—Silica follows well after calcarea. The silica patient has a head disproportionately large to the rest of the body; the sweat appears on the whole head and face rather than on the scalp alone, and the foot sweat causes soreness of the feet; there is great heat and redness of the face, and cold hands and feet; great drowsiness; sudden starting in sleep; sour eructation; nausea and vomiting.

Hepar sulph. may bring about absorption of the tuberculous deposit.

Kali iod.—This remedy is indicated both before and after the tubercular exudation has taken place. It is indicated by stinging, darting pains in the head, preventing sleep; pain and heat in the head, with burning and redness of the face; hemorrhage from the nose; drowsiness; dry, hacking cough; spasmodic contractions of the muscles; chilliness alternating with flashes of heat; paralysis especially when hemiplegic. (Hart.)

Spongia.—This is Herrington's great remedy for scrofulous and tuberculous subjects. The special indications are: Redness of face, with anxious expression of countenance; determination of blood to the head; heat in the head; bending of the head backward; face alternately red and pale; eyes staring; lids wide open; vision double; child frequently awakes with a start; muscular twitching accompanies the fever; somnolence and stupor.

Chronic Hydrocephalus.*

This is a disease characterized by the gradual enlargement of the head, the result of an effusion of serum into the ventricles of the brain. Associated with this disease there is mental deficiency and symptoms of brain irritation.

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* The old term "acute hydrocephalus" meant an acute inflammation with effusion, now known as "tubercular meningitis."

Hydrocephalus has been distinguished into internal and external. In the one the fluid distends the lateral ventricles; in the other it is between the brain and the membranes.[†] Hydrocephalus alone is not very common. It is not unfrequent to have hydrocephalus internus and externus at once. It is essentially a disease of childhood, and in the majority of cases is congenital. As a rule, it begins to manifest itself about the second or third month; in rare cases, however, it may be present at birth.

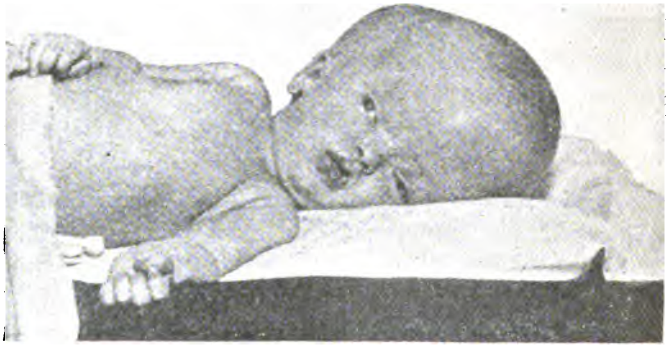

FIG. 66.—SHOWING THE COMPARATIVE SIZE OF THE HEAD TO THE BODY IN CHRONIC HYDROCEPHALUS.

The deformity of the head which is characteristic of this disease is due to a low grade of inflammation (tubercular in character) of the pia mater and the consequent accumulation of large quantities of serum into the cavities of the ventricles and the arachnoid and subarachnoidean spaces; thereby causing distention of the ventricles and separation of the sutures. The amount of fluid contained within the cranium is sometimes enormous. Cases are on record where the cranium con-

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* Ireland, "Idiocy and Imbecility."

tained in one instance twenty pounds and in another instance twenty-seven pounds; the craniums measuring in circumference forty and fifty-two inches, respectively.

The chief noticeable symptom is the change in the shape of the head, there being a marked enlargement in the frontal region, the widest circumference being often at the temples; there may be flattening posteriorly. The great circumference of the cranium, the overhanging brow, the open fontanels, and the unclosed sutures make the diagnosis easy.

The only disease with which it is likely to be confounded is *hypertrophy* of the brain, a much rarer malady; in fact, it could hardly be confounded with any other affection. Tuke * gives the following points of differential diagnosis between *hypertrophy* of the brain and *chronic hydrocephalus:*

1. In hypertrophy of the brain, as a rule, the head does not attain so large a size as in chronic hydrocephalus.

2. In hydrocephalus the increase in the size of the head is most marked at the temples; in hypertrophy, above the superciliary ridges.

3. In hypertrophy the head approaches the square in shape; in hydrocephalus it is rounded.

4. In hydrocephalus there is often an elasticity over the late closed fontanel; in hypertrophy there is none, and there is often a depression in that situation.

5. In hydrocephalus the distance between the eyes is increased from the fluid inserting itself between and extending the sutures formed by the frontal and ethmoid bones; in hypertrophy this is not the case.

The prognosis is usually unfavorable, the greater majority dying before the end of the third year. In rare instances, however, the disease ceases to progress, and the child reaches the adult period of life and enjoys comparatively good health.

Treatment.—Treatment has very little if any influence upon this affection. Surgical treatment by tapping and drawing away some of the fluid relieves temporarily; but the majority of cases die within one or two years. The remedies given for *acute hydrocephalus* and *acute meningitis* are applicable in this affection.

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* "Dictionary of Psychological Medicine."

Cerebral Anæmia.

Cerebral anæmia may be acute or chronic; it may be due to deficiency in the quantity or quality of the blood sent to the brain; it may be either local or general—that is, it may occur as a result of a complete or partial obstruction of the arteries from thrombi, emboli, tumors, and inflammatory changes, or it may occur in connection with general anæmia of the body. It may occur as the result of repeated hemorrhages or exhausting discharges, such as chronic dysentery, diarrhea, and albuminuria. Other causes are cardiac weakness, such as mitral stenosis or regurgitation; pressure of tumors on the vessels leading to the brain; insufficient nutrition, either from deficient or improper food or diseases of the digestive and assimilative organs.

Symptoms.—The symptoms vary according as to whether the anæmia is suddenly or slowly produced. When the anæmia is the result of profuse hemorrhage, the most prominent symptom is fainting or syncope.

Where the anæmia comes on slowly, the patient is subject to severe headaches. The pain is most frequently vertical; it occupies the top of the head, which feels hot and burning to the hand. The pain is not throbbing or bursting, but of a gnawing, scraping character. It may also be frontal, and usually in that case there is a peculiar sensation, as though the eyes were being drawn backward. The patient is also subject to giddiness, noises in the ears, flashes of light before the eyes, lassitude, and nervous irritability. In some cases there is mental dullness and drowsiness; in others, however, insomnia is a troublesome symptom. The pulse is frequent, thread-like, and weak; the sounds are short and indistinct. Feebleness of muscular power is always met with, and there may be general or partial paralysis. The general appearance of the patient is indicative of this affection; the face is pale, the lips almost colorless, and the skin is cold and clammy.

Pathology.—The brain and its membranes are pale and anæmic, especially noticeable in the cortex. The contrast between the gray and white matter is less marked, and the small blood-points usually seen on section from divided vessels are almost entirely absent; there is a large amount of effused serum in the meshes of the pia mater and between the convolutions, but the ventricles of the brain are generally empty.

Treatment.—When due to sudden causes, as shocks, severe hemorrhage, etc., for immediate relief, to assist the immediate recovery of cardiac action, place the patient in the recumbent position and apply stimulants. A few drops of nitrite amyl applied on a handkerchief and inhaled; a few drops of camphor or veratrum alb. on the tongue, or a little brandy; cold water dashed in the face; the application of the faradic current over the epigastric region—all are expedients to be thought of in emergency cases. When the patient recovers consciousness, then the therapeutical treatment will be selected according to the causes and symptoms.

Kali carb.—Kali exerts an influence over the manufacture of the blood quantitatively as well as qualitatively. The patient suffers from vertigo when he turns his head rapidly, or from riding in a carriage, or from anything that diminishes the supply of blood to the brain; there is humming in the ears, weakness of sight; the pulse is weak, rapid, and irregular or intermittent (characteristic of the drug). The patient complains of chilliness every time she goes out of doors, if the air is the least cool; she complains of a troublesome backache, a weak, lame feeling in the small of the back which makes walking very difficult; and she suffers from cough and frequent sweating at night. This remedy is especially useful in anæmia following labor or abortion.

Alumina.—Wrinkled and dried up looking; nutrition is decidedly defective; the bowels are inactive—this constipation is characteristic; there is a great deal of urging to stool even though the fæces be soft; patient low-spirited and inclined to weep, and this low-spiritedness is worse on awakening; an apprehensive state of the mind; lassitude and indifference to labor or work; an hour seems to them half a day; exceedingly peevish and fretful. Especially useful in young girls at puberty when the menses are pale and scanty, and there is an abnormal craving for certain indigestible articles such as slate pencils, chalk, whitewash, charcoal, etc.

China.—This remedy is useful only when the anæmia comes from the loss of fluids. Hence, it may be used for the loss of hemorrhages, whether it be from the mouth, lungs, or uterus. Also it will be called for when long-lasting leucorrhœa or diarrhea has exhausted the patient. There is a peculiar sensation to external impressions or noises, to a bright light, or to anything that is liable to render the patient irritable. There is experienced a peculiar form of headache which is characterized by dull aching and at other times by throbbing in the head. There are well-marked, ringing sounds in the ears; also vertigo. The surface of the body is rather cool, especially the prominent features of the face: thus the ears, nose, and chin are cold.

Calcarea phos.—This remedy is called for in certain conditions similar to china, but it is a more deeply acting drug.

Phosphoric acid.—This remedy is especially useful in anæmia of a nervous origin, when it is not connected with any pain, except, perhaps, a simple burning in the spine or in the limbs. The mind is rather apathetic, and the patient is inclined to be drowsy and sleepy. The characteristic of this sleepiness is that he is easily aroused from it and is wide awake.

Ferrum.—This remedy is indicated in pure anæmia, with an appearance of plethora; cheeks flushed a bright red, giving them an appearance of blooming health. When they are unexcited and quiet the cheeks are apt to be pale and the face has an earthy color. There is a violent hammering headache, which is usually periodical in its return, and worse after twelve o'clock at night. It is especially indicated in those persons who are subject to nose-bleed.

Natrum mur.—This remedy is frequently indicated when the blood is impoverished. The patient is emaciated, and he feels greatly exhausted from any exertion of mind or body; he suffers frequently from palpitation of the heart, and this, too, is excited by every emotion; he wakes up at night with palpitation of the heart and cannot go to sleep again; mental ability impaired; makes mistakes; easily confused; loss of memory; limbs go to sleep, with "crawling" sensations even in the lips and tongue; limbs heavy. Especially useful in anæmic girls whose menses are scanty or suppressed; also in anæmia produced by the loss of fluids.

Arsenicum alb.—Great anxiety, with constriction of the chest and dyspnœa; great anguish and restlessness; trembling; cold sweats; prostration; vertigo when shutting the eyes as if he would fall; buzzing in the ears; tensive, pressing pain spreading to the forehead and temples, and to the occipit and nape of the neck, which comes in violent attacks as if the head would burst; face pale, yellow or earthy; face pale, cold and bloated; sunken, old-looking face; blue rings around the eyes; appetite variable, but more frequently loss of appetite; excessive thirst for cold water; drinks very little at a time. Arsenicum is especially useful in cases of general debility where assimilation is at fault.

Cerebral Congestion.

(*Hyperæmia of the Brain, Brain Fever.*)

This is an affection on which different writers vary widely in their description of what constitutes a case of cerebral congestion. Some have classed cases under this heading which were undoubtedly inflammatory in nature; others have described cases of pure hypochondria; while still others have doubted even the possibility of this condition. The truth lies between the two extremes, but its precise position is still undetermined, and there is still room for wide differences between them. There would seem to be precisely the same ground for a recognition of cerebral congestion as a separate and distinct form of disease that there is for recognition of congestion in any other organ or part of the body.

The beginning of all inflammation is congestion; therefore we do not think it true that every form of congestion necessarily involves inflammation. However, should the congestion be long unrelieved, or of great violence, the transition to the state of inflammation will be easy and sure.

Who that has seen a case which was enjoying the very best of health suddenly taken with high fever, severe headache, or a sense of fullness of the head, noises in the ears, a flushed face, throbbing carotids, injected eyeballs, delirium, somnolence, a tendency to convulsions, and all the concomitant symptoms that go to make up an inflammatory condition of the brain and its membranes, but which under appropriate treatment was quickly and completely relieved, followed by none of the sequelæ or consequences of inflammation, can doubt that it was purely an active congestion of the brain and its membranes? Whatever difficulty there may be in accepting this explanation of such cases, it is at present very difficult to find any other, especially when the attacks are brief and recur frequently. Well-marked instances are frequently seen in children. The throbbing headache produced by nitrite of amyl seems in itself to prove the possibility of active congestion of the brain.

Cerebral congestion is of two kinds—active, or arterial, and passive, or venous. In the former a larger quantity of blood than usual is sent to the brain; while in the latter there is no actual increase in the amount of blood sent to the brain, but, owing to obstruction, it does not return freely, and thereby causes a dilatation of the cerebral veins. Both varieties may be general or local.

Ætiology.—Whatever tends to increase the arterial supply of the brain or its covering, or whatever obstructs or impedes the return of blood from the head, acts as the immediate cause of cerebral congestion.

The active variety may be caused by overaction of the heart, the result either of hypertrophy or excited action, as in fever, mental excitement, or severe physical exertion; exposure to extremes of heat and cold; suppression of habitual discharges, such as bleeding piles, catamenia, etc.; certain drugs, as nitrite of amyl, glonoine, belladonna, quinine; also, alcoholic excess and excessive mental work. Stout, plethoric people are more prone to congestion than those who are not so. The dilatation of the arterioles of the brain, and consequently an increase of blood-supply, may also be produced by emotional excitement.

The passive variety is produced by causes that interfere with the return of blood from the brain, such as goiter, tumors of the neck or tumors pressing on the superior vena cava or on the innominate veins; playing upon wind instruments; violent fits of coughing, such as in croup, whooping cough, etc.; valvular disease of the heart; prolonged straining at stool or in childbirth; or any labor that requires a pendent position of the head.

ACTIVE CONGESTION.—The symptoms of active cerebral congestion may be classed under two heads: those of *excitation* and those of *depression*. Under the former may occur such symptoms as: 1. Insomnia; the patient is unable to get sleep until near morning; ofttimes it is unrefreshing and broken by unpleasant dreams, so that he generally avers that he feels as tired and unrefreshed as though he had not slept at all. 2. Headache; this may be of a dull, aching, throbbing character or extremely severe; a sense of fullness; heat and pain in the head; sparks before the eyes; intolerance of light and noise; ringing or buzzing in the ears; throbbing of the carotids; vertigo; great mental excitement and irritability.

The symptoms of depression are for the most part the reverse of these. The head feels dull and heavy and there is dullness of the senses; insensitive to bright light or loud noises, etc., pupils dilated; sluggishness of the intellectual faculties; respiration slow, irregular, or stertorous; a gradual stupor, which may pass into coma; there may be anæsthesia and some degree of paresis.

PASSIVE CONGESTION.—The symptoms of irritation in the passive variety are less intense than in the active form, although many of the symptoms given in the active form may also be met with in the passive form. A dull headache, chiefly frontal, sometimes throbbing, or a sense of fullness. The headache is aggravated by coughing, stooping, and by all muscular effort. The face is congested, turgid; conjunctiva congested. There may be convulsions, and even paralysis. There is mental dullness, also disturbed sleep. There is somnolence instead of insomnia.

The chief diagnostic indications of cerebral congestion of either variety are the increase of the symptoms by influences that increase the amount of blood in the head, and their diminution by their opposite influences. (Gowers.)

Hammond draws attention to a peculiar symptom that may be met with in many cases of cerebral congestion—namely, an extreme irritability of the vascular system, so that the least movement, such as rising erect from a sitting posture or to the sitting from the recumbent, leads to the acceleration of the pulse of from twenty to thirty, or even forty beats a minute. Besides this, there are frequent and violent palpitations, either spontaneous or provoked by the most insignificant causes, either mental or physical. This is independent of any organic lesion, and is to be attributed to cerebral disturbances.

Pathology.—The appearance of brain tissue after death does not always furnish reliable indications of its blood contents during life. In section of hyperæmic brains the small blood-points from the cut ends of small vessels are more numerous and conspicuous than under normal conditions, and the brain tissue, particularly the gray matter, may have a diffuse red color. According to Delafield and Prudden, if the congestion is excessive, the convolutions may be somewhat flattened, the brain tissue and pia mater œdematous, and the ventricles contain fluid. Necropsies upon children dying from convulsions have shown the brain and its membranes to be more or less congested and a serous effusion in the ventricles or arachnoid cavity; also, in some instances, one or more hemorrhagic spots, and fibrinous clots in the large vessels and sinuses.

Treatment.—In the active type the object should be to lessen the force of the cerebral circulation and the quantity of blood in the blood-vessels of the brain. This is accomplished chiefly by aconite, belladonna, veratrum vir., and gelsemium, according to indications, and as adjunct treatment the head douche. In the passive variety the first object is to remove the obstruction, if possible, and then rely upon the therapeutical treatment to restore the cerebral vessels to their normal tone.

Aconite.—Aconite is especially indicated in the first stages of the active type of congestion; there is great heat of the head; dry, burning heat of the skin of the body; restlessness and anxiety; throbbing pains in the head; a bursting headache; congestive headache; severe vertigo; face hot and red, or pale; flashes of light before the eyes; photophobia; buzzing in the ears; palpitation of the heart; pulse full and bounding; unquenchable thirst for large quantities of water; ***great nervous excitability, with fear and anguish of mind.***

Agaricus.—This remedy acts especially on the nervous system, on the brain, and spinal cord; great debility with trembling of the limbs; convulsions with trembling of the limbs; especially in persons who drink to excess; twitching of the eyeballs and eyelids; muscæ volitantes; vertigo, with muscular trembling. Especially indicated in *venous* congestion, and in congestion due to the excessive use of alcohol and from septic diseases.

Belladonna.—No remedy in the Materia Medica possesses a wider range of action or greater powers for removing abnormal conditions of the brain than belladonna. Its symptoms are clear, well defined, and unmistakable. Its action sharp, vigorous, and profound. It is the powerful supplementary ally of aconite in removing the last vestige of cerebral congestion; and beyond this it subdues like magic the subtler processes of inflammation. It is indicated in acute, active, and violent congestion, with intense throbbing headache, with sharp, shooting pains which are so violent as to make the patient scream. These pains come almost like a flash, and disappear as suddenly as they came; carotids throb violently; jugulars swollen; face flushed and bloated; white of the eyes injected; convulsive movements of the eyeballs; terrible pressing pain in the eyeball; great photophobia; light and noise intolerable; noises in the ears; flashes of light; head drawn backward and boring of the head in pillow; twitching of groups of muscles; jerking of the limbs or even convulsions; patient may be either very drowsy or very wakeful; drowsy, falls into a heavy slumber and is aroused from this startled; cries out; *sleepy but cannot sleep.*

Veratrum vir.—Of all the remedies in the Materia Medica there is not one that will surpass veratrum vir. in the treatment of cerebral congestion. It is suited either to the active or the passive type. Its characteristics are *great rapidity of the pulse with a tendency to convulsions;* intense cerebral congestion, feeling as if the head would burst open, with violent throbbing of the carotids and temporal arteries; flushed face, or face purple; livid color of the face in convulsions; nose looks pinched, cold, and blue; vertigo; ringing in the ears; very sensitive to noise; dimness of vision; nausea and vomiting; oppressed respiration; palpitation of heart; tingling and numbness in the limbs.

Glonoine.—Glonoine is indicated in a more intense form of congestion than that calling for belladonna. No remedy causes so quickly and so violently such a severe congestive, throbbing, and bursting headache as does glonoine. It is indicated where there is intense congestion of blood to the head, with a feeling as if the temples and top of the head would burst; the blood seems to surge in one great current up the spine and into the head; all the blood seems to be pumped upward; a feeling as if the head were too large and full of blood; the head seems as if it were expanding (one of the most prominent symptoms of glonoine); severe, tensive headache over the eyes and nose, with choking sensation about the throat, with fullness in the base of the brain and violent throbbing of all the arteries of the head and back of the neck; the throbbing is synchronous with every impulse of the heart; brain feels as if moving in waves; headache with violent vertigo, nausea, and vomiting; headache with increased secretion of urine; the face is deep red, eyes are often fixed, pupils dilated; eyes injected red, protruding, wild, staring, or may be just the opposite, dull, staring, sunken; eyes rolled upward; flashes of light before the eyes; photophobia; ringing in the ears; audible pulse; sensation of fullness in and around the ears; oppressive breathing, with palpitation of the heart; congestive headache; sun stroke; the headache worse from shaking or jarring the head, bending the head backward and worse from the application of cold water, even *causing spasms.*

Gelsemium.—A dull, compressed headache, spreading from the occiput over the whole head, or to the forehead and eyes; heaviness of the head with dullness of mind, dimness of sight and vertigo; head feels too big and often too light; brain feels as if bruised; swimming sensation in the head; heat of the face; pain in the nape of the neck, with disposition to throw the head backward; no thirst; no appetite. This is one of our most reliable remedies, when during dentition children become drowsy, comatose, and convulsive as a result of hyperæmia of the brain; also in cases due to suppression of the menses, or exposure to the rays of the sun.

Opium.—Violent congestion with tearing pains; a sense of heaviness and pressure from within outward; drowsiness, a comatose sleep; sighing and moaning; face deep red and swollen; pulse full, round, and slow; respiration is deep and as the stupor grows in intensity it becomes heavier and finally stertorous; profound stupor, or else the opposite condition of wakefulness, with delirium; flushing of the face; noises in the ears; throbbing of the temporal arteries; spasms and convulsions; tongue coated white or dirty-white with dryness of the mouth; thirst; sour eructations; nausea and vomiting.

Aurum mur.—Rushes of blood to the head and brain, aggravated by mental labor; headache; a feeling of fullness in the head accompanied by roaring in the ears; great sensitiveness to noise; giddiness; vertigo when stooping as if turning in a circle; face bloated and glassy-looking, or a bluish complexion; sparks before the eyes; double vision, or he suffers from what is known as half sight; sensation in the eye as though it were being pushed out; great anguish with palpitation of the heart; oppression or real paroxysms of suffocation, with sensations as if the chest were constricted.

Amyl nit.—Throbbing with sense of heat and fullness in the head, accompanied by intense flushing of the face, a deep labored breathing or an exceedingly rapid, violent action of the heart; beating, throbbing, bursting sensation in the head and ears, with constriction of the throat and heart.

Bryonia.—Bryonia is of great value in simple non-inflammatory congestion of the brain, arising from suppressed menstruation, or exposure to intense cold. Congestive headache as if the forehead would burst open, sometimes accompanied with bleeding from the nose which does not relieve; a splitting headache; confusion of the head; great heaviness of the whole head; throbbing headache in the top of the head; painful compressive sensation in both sides of the head as if everything would fall out of the head when stooping; headache in the occiput extending to the shoulder; vertigo, especially when first rising up; the least attempt to raise the head from the pillow causes a feeling of faintness and nausea; great irritability, wishes to be left alone; wishes to be left perfectly quiet; face flushed and of a deep red color; red, bloated face; tongue coated white and is especially marked down the middle; a dry tongue; constipation, stool dry and hard as if burned; stools large, solid, and evacuated with great difficulty; motion, mental excitement, and nausea aggravates the headache.

Nux vom.—Headache in the forehead as if the eyes would be pressed out, or in the occiput; dullness and confusion of the head; drowsiness with a tendency to coma, or the opposite condition of wakefulness; great heaviness of the head, especially when moving the eyes; sensation when thinking as if the head would split; aggravation of the symptoms in the morning, in the open air, and from noises. Nux is especially indicated in cases brought on by alcoholic excesses, or from over mental work.

Coffea.—Great sensitiveness, with general excitability; wakefulness; headache as if a nail were driven into the brain, or as if the head would fly to pieces; heat in the head and face; flushing of the face, with cold feet; shining, red eyes; especially indicated in apoplectic congestion brought on by an excited state of the mind.

Strontiana carb.—Especially useful in threatening apoplexy, with violent congestion of the head; the least exertion causes the blood to rush upward toward the head; the face becomes flushed and hot; violent throbbing of the arteries; there is a smothering feeling about the heart and a feeling as of a load on the chest. The head symptoms are relieved by wrapping the head up warmly (a characteristic symptom).

Arnica.—Arnica is admitted to be the best remedy for hyperæmia consequent upon concussion of the brain by a fall, blow, etc., or by other mechanical impressions. So far as the wounded locality is concerned, it may be well to apply arnica externally, but this will not be of any special benefit to the congestion.

Cerebral Hemorrhage.

(*Apoplectic or Paralytic Stroke.*)

Under the heading of "Cerebral Hemorrhage" will also be included two other affections: 1. Embolism, which means the occlusion of a cerebral artery by a plug carried by the blood to the brain; this plug being the result of a morbid process somewhere between the lungs and brain, usually the heart. Embolism of cerebral arteries occurs in patients affected with disease of the aortic or mitral valves owing to former endocarditis; particles of fibrine are suddenly separated from warty growths on these valves, are carried along with the stream of blood, and plug up the cerebral artery. 2. Thrombosis, which means a coagulation of blood in a vessel during life, due to a narrowing of the caliber of an artery of the brain, the result of a local disease of the artery. According to Gowers, it may be the result of a change in the constitution of the blood, rendering it prone to coagulate; also a slower movement of the blood, from feebleness of the heart, sometimes produces thrombosis when the arteries are free from disease.

The term "*cerebral hemorrhage*" includes not only hemorrhage of the cerebrum and its basal ganglia, but also hemorrhage from the cerebellum, pons, and medulla, and is used to distinguish it from the term "*meningeal hemorrhage,*" which means hemorrhage from the meningeal coverings of the brain.

Cerebral hemorrhage is due to the rupture of a blood-vessel (usually an artery, rarely a vein), and the consequent extravasation of blood into the substance of the brain or into its ventricles. The rupture of a vessel may occur in the substance of the cerebrum or in the ventricles. The most frequent seat of hemorrhage is in the corpora striata and optic thalami and in the brain tissue in their vicinity; about half the total number of cerebral hemorrhages occur at this point; next in frequency the centrum ovale, then successively the cortex, the pons, and the cerebellum.

The middle cerebral artery and its branches is the one most frequently affected. There is usually but one recent extravasation, but occasionally two or more occur simultaneously; especially is this the case in certain constitutional diseases with a tendency to hemorrhage. "In leucocythemia more than fifty small hemorrhages have been found." (Gowers.)

Hemorrhages are due, in a considerable proportion of cases, to the rupture of small arterial aneurisms; but may arise from weakening of the walls of the arteries, atheroma, or fatty degeneration. Aneurisms of the cerebral arteries may be as large as a pea or hazel-nut, but those most frequently met with and causing apoplexy are usually small, called miliary aneurisms, and may be microscopic in size, varying from this up to that of a large pin-head or larger. They may occur in any of the small arteries of the brain, but are most frequent in the branches of the middle cerebral artery.

As the blood is poured out from a ruptured vessel the brain tissue is separated or torn and lacerated; so that the clot does not always consist of blood alone, but also brain-tissue is often mixed with it; the blood is clotted and reddish-black in color. The size of the clot varies from that of a small pea to that of a large orange. The blood may burst into the ventricles, filling them and rupturing the septum lucidum, thus converting the two lateral ventricles into one, or it may tear its way to the surface of the brain and give rise to serious compression. Certain convolutions become flattened and anæmic and the surface dry. The extravasation takes place into the ventricles in about one-half of all the cases.

Soon the extravasated blood undergoes certain changes. At first the fluid parts of the diffused blood are absorbed, and a cyst is formed around the clot, which in the course of time likewise disappears. The cyst then shrinks up, and at last only the cicatrix is found; rarely, however, does the clot entirely disappear. Again, in other cases, a cavity remains filled with a clear or colored fluid and surrounded by a smooth wall. The process of degeneration and absorption of the blood and broken-down brain-tissues, and their replacement by a cicatrix or a cyst, is a slow one. In some cases the process of reparation

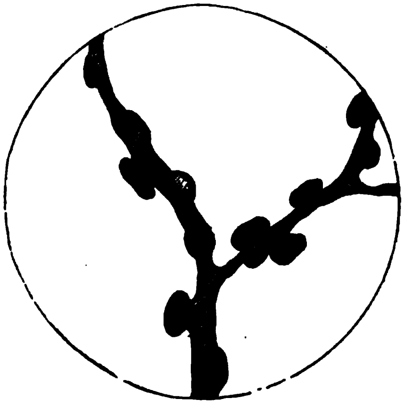

FIG. 67.—MILIARY ANEURISMS. (After Hamilton.)

is accompanied by gradual amelioration of the paralytic symptoms, and spontaneous recovery may take place. In other instances the gradual shrinking of the cyst acts as an irritant on the brain.

Ætiology.—Heredity plays a certain part in causing hemorrhage by inducing the tendency to arterial disease, so that it is well established that certain families have a predisposition to this condition. No age is excluded, but it occurs most frequently between the ages of thirty and sixty. The degenerative tendency incidental to advanced life is, in the majority of cases, the most powerful element in the production of cerebral hemorrhage. It is more frequent in males than in females. Chronic alcoholism; hypertrophy of the left ventricle; valvular lesion of the heart, causing regurgitation; chronic renal diseases, especially Bright's disease; chlorosis; scurvy; syphilis; gout; pernicious anæmia, and especially leucocythæmia—all may act as predisposing causes.

Exciting causes would include all mental or physical conditions which tend to increase the heart's action or to suddenly increase the blood-pressure, from muscular effort, such as attacks of violent coughing, as in whooping-cough; vomiting; straining at stool; lifting a heavy weight; sudden rage, grief, or mental excitement; the sexual act; the recumbent position of the head, as from stooping to tie the shoe or to pick up something; trauma, as falls, blows, etc.; also, apoplexy is very apt to happen after dinner and during sleep; one attack is likely sooner or later to be followed by another.

Symptoms.—The symptoms of embolism and thrombosis, in the main, correspond to those of cerebral hemorrhage. Many writers state that a diagnosis between embolism, thrombosis, and hemorrhage can be made by *clinical* symptoms alone; that in case of embolism the onset is sudden, and that thrombosis and hemorrhage will be more gradual. These statements are inaccurate, for an embolus may enter a capillary that it does not completely plug up at once, so that the onset of the symptoms may be gradual. A thrombosis, on the other

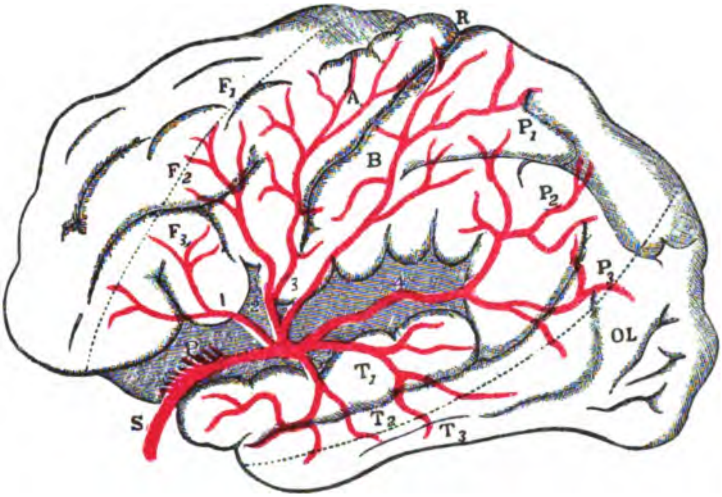

FIG. 68, PLATE XIII.—DIAGRAM SHOWING THE AREA OF DISTRIBUTION OF THE MIDDLE CEREBRAL ARTERY.—*S*, Sylvian or middle cerebral artery; *P*, perforative (ganglionic) branches; *I*, inferior frontal branch to Broca's convolution; 2, ascending frontal branch; 4 and 5, parieto-sphenoidal and sphenoidal branches; *A*, ascending frontal convolution; *B*, ascending parietal convolution; *F1*, *F2*, *F3*, first, second, and third frontal convolution; *P1*, *P2*, *P3*, first, second, and third parietal convolutions; *T1*, *T2*, *T3*, first, second, and third temporo-sphenoidal convolutions; *OL*, occipital lobe; *R*, fissure of Rolando. This artery and its branches is the one most frequently affected in cerebral hemorrhage.

hand, may form so very gradually as to produce no symptoms until, by the superimposition upon it of layers of fibrin, the final moment of occlusion of a vessel has been reached, when it may plug up the vessel suddenly and completely, and the symptoms would also be sudden. A hemorrhage may be produced by sudden or gradual rupture of a vessel, so that the symptoms may be either sudden or gradual.

Dr. L. C. Gray of New York, in writing on this subject, says: " I have made a number of *post-mortems* in which I have satisfied myself of the impossibility of making a diagnosis between embolism, thrombosis, and hemorrhage by means of the suddenness and gradualness of the symptoms.. I am therefore positive that it is utterly impossible to make a diagnosis between the three conditions in this way. Usually, therefore, the first thing to be sought for will be the cardiac or pulmonary lesion that might give rise to emboli. If they are found and if the onset has been sudden, a diagnosis of embolism is probable, although these cardiac and pulmonary conditions may have existed without having caused emboli. If these cardiac and pulmonary sources of embolism are absent, however, it is utterly impossible to make a diagnosis between embolism, thrombosis, and hemorrhage."

The symptoms will vary according to the location of the clot, to the amount of blood that escapes, and to the degree of damage to the brain structures. The attack may be preceded a few hours, or in some cases even several days, by premonitory symptoms, such as headache, vertigo, slight confusion of mind, a tendency to stupor, vomiting, numbness limited to one side of the body, nosebleed, transient disturbance of speech, irritability of temper, double vision, etc. But more frequently the onset is abrupt; the attack is ushered in without previous head symptoms of any kind. The patient, without warning, falls insensible, as if " struck down "; the sudden loss of consciousness is soon followed by profound coma. When the effusion occurs slowly, consciousness may be lost, not suddenly at the onset, but gradually as the hemorrhage attains a considerable size.

Occasionally the attack is ushered in by clonic convulsions, or by paralysis of the arm, leg, face, or some other part.

When, whatever the beginning, the attack has reached its height, the patient lies in a comatose state, or as if in a deep sleep; respiration is slow and stertorous; the lips and cheeks are puffed out with each respiration; the eyes are half open and fixed, the pupils widely dilated and sluggish, and there is conjugate deviation; the face is usually flushed or cyanotic and swollen; occasionally it is pale, with a pinched expression; the surface of the body is usually wet with perspiration; reflexes are temporarily abolished; the limbs are motionless and flaccid, and when lifted fall passively and (to all appearances) lifeless to the ground; there is loss of control of the sphincters, and, consequently involuntary discharges take place from the bladder and rectum.

In severe cases the breathing becomes irregular, of the Cheyne-Stokes variety, and there is difficulty of deglutition. The pulse is generally slow and full. The temperature of the body is at first lowered by several degrees, going down sometimes to 96½° F., but this is followed by a stationary, normal period, and not infrequently by a rapid rise, which again, as the patient recovers, is succeeded by return to the natural body heat. In severe cases, where large hemorrhages take place, the temperature never rises, or only rises to fall with the recurrence of the fatal bleeding. In fatal cases it may run up as high as 108°. It is an unfavorable symptom when the stationary period is short or absent and there is a continuous rise in the temperature after the previous depression.

In severe cases the coma may last for hours, or even days, and before the initial coma has passed away it may be suddenly deepened, or consciousness after being regained may be suddenly lost, in consequence of the extravasation bursting into the ventricles. (Gowers.) Death may result in a few hours. In cases of moderate severity the coma is not so profound and the symptoms are generally of a milder type. Reflex action returns in a few hours (one to six), and the patient shows some signs of returning consciousness; may make some movement, moving the parts that are not paralyzed; may open his eyes when spoken to.

A dull, general headache is usually felt as consciousness returns, and it is then observed that there is loss of power of certain groups of muscles (monoplegia), or, as is more frequently the case, a complete hemiplegia. The hemiplegia affects the arm more than the leg, and the face least of all.. Only the lower two branches of the facial nerve are involved and the patient can shut the eyes. There may be hemianæsthesia.

Within three or four days after the onset there is apt to occur a rise in the temperature, and other febrile manifestations, such as headache, loss of appetite, etc.; or, in more severe cases, the temperature may run still higher, and there is loss of consciousness again, and delirium. This is due to inflammatory changes around the cerebral lesion. In a short time the cerebral symptoms, such as headache, delirium, etc., subside and the intellectual faculties begin to resume their normal sway. But in many cases there remains evidence of some mental change, which may be slight or considerable. It may be a mere dullness of apprehension, or the memory may be defective. The patient has lost control of the emotions, he is more irritable and peevish, and is apt to be apathetic or surly. As the general cerebral symptoms lessen, the local symptoms, such as monoplegia or hemiplegia, become more prominent.

The paralysis, which may have been very extensive at first, gradually passes away, with the exception of certain muscles or groups of muscles which are directly affected. The return of movement in the unaffected parts defines the degree of paralysis. This may consist of a monoplegia or a hemiplegia, which may persist for months or even for life, unless the loss is of such a character that it can be supplemented by the action of the other hemisphere. Occasionally, though rarely, the paralyzed limb may atrophy. The tendon reflexes are exaggerated and the foot-clonus can be obtained.

After a longer or shorter time, the muscles undergo contracture, thus producing various kinds of deformities. The contractures affect the extensors of the foot more than the flexors. These contractures are seldom ever recovered from. Within a few weeks after the attack the larger joints of the paralyzed side begin to show symptoms of acute synovitis; bed-sores may be developed in some cases, and are usually an unfavorable symptom.

There is a symptom known as "post-paralytic or hemiplegic chorea"; this is liable to occur when the hemorrhage causes a lesion of the internal capsule. It consists of a tremor or choreiform movement, resembling true chorea in many instances.

Conjugate deviation of the eyes is a symptom of the greatest diagnostic value when it occurs, for it is indicative of a definite cerebral lesion. In this condition the head is strongly turned to one or the other shoulder, both eyes being strongly deviated in the same direction; it is as though the patient were making a persistent effort to look over one or the other shoulder. When the lesion is simply *irritative*, the head and eyes are turned toward the side of the body which is convulsed, and away from the hemisphere which is affected; while, on the other hand, when the lesion is *destructive*, there is conjugate deviation of the eyes, with rotation of the head away from the paralyzed side toward that hemisphere which is the seat of the lesion. Grasset has formulated the following rules in reference to the diagnostic value of conjugate deviation of the head and eyes: (1) When conjugate deviation exists with a lesion in one of the cerebral hemispheres, the patient looks to the side of convulsions when this exists, and looks in the direction of his lesion when there is paralysis and no convulsions. (2) In lesions of the pons Varolii, where conjugate deviation exists, the patient looks toward his paralyzed limbs when there is paralysis, and toward his lesion when there are spasms or convulsions. It will be noticed that when there is a lesion in the lower part of the pons on one side, the direction of the deviation of the head and eyes is the reverse of that when the lesion is higher up in the cerebral hemisphere on the same side. It is this definiteness of indication that gives the sign its value, in the first place, for the diagnosis of apoplexy itself, and secondarily, for the information which it is capable of affording as to the side of the brain that is damaged, at a time when no other sign may be forthcoming even as to the existence of a hemiplegic condition.

Bastian * in speaking of the significance of this sign, says: " Supposing a patient who is already hemiplegic, but quite conscious and going on well, more or less suddenly lapses into an apopleptic condition, but shows a conjugate deviation of the head and eyes in the direction of the previously paralyzed limb. Now to a person not knowing the exact significance of the latter sign the most natural supposition would be that the apoplectic condition was due to some extension of the disease in or near the old focus. But to a person knowing its real significance the indication would clearly be that something much more grave had occurred—that is, that the previously sound cerebral hemisphere had now become the seat of the disease. And, with lesions in both hemispheres, the patient's condition would be rendered much more helpless, both mentally and physically, even should he survive the additional perils attaching to such an apoplectic state." The deviation of the eyes and head to one side usually disappears in a day or two.

Symmetrical lesions of both sides of the brain, and in exactly the same place and at the same time. are very apt to occur. This vascular and tropho-organic sympathy of the two hemispheres, extending to diseased conditions, is a most important fact not noticed in pathological works, but physiologically and pathologically it must be kept in mind in brain study.

REGIONAL LOCALIZATION.

Hemorrhage into the Substance of the Cortex.—Is indicated by convulsions, which may be either localized throughout the entire limb that is paralyzed, or else the convulsion starts in this limb, often being confined to it for a distinct though short period, and extends to the other limb of the same side, or may become generalized. This is soon followed by paralysis of one limb or a group of muscles (monoplegia). The palsy begins on the opposite side of the body from the lesion. Consciousness is rarely lost, and there is little if any disturbance of sensation.

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* " Paralysis, Cerebral, Bulbar, and Spinal."

Hemorrhage into the Centrum Ovale.—Causes symptoms similar to those due to cortical lesions but without the irritable symptoms in so marked a degree; the convulsions, however, are not of so pronounced a type as in the cortical lesion.

Hemorrhage into the Ventricles.—There is profound coma, possibly because the cerebro-spinal fluid is more liable to be displaced from the ventricles; tonic contraction of the muscles either in one or both sides; later there is general relaxation of all the muscles and loss of all reflex action. (Gowers.) The respiration is embarrassed; the pulse is slow; the temperature falls below normal; there is conjugate deviation of the head and eyes (toward the paralyzed side); the pupils are dilated; the chest is rapidly filled with rales; the face becomes livid. This form of hemorrhage is usually fatal, the patient dying from interference with breathing.

Hemorrhage into the Corpora Striata.—When the clot is strictly limited to the corpora striata, the paralysis, however extensive it may have been in the first place, is of a transitory character, and there is no tendency to muscular contraction at a late period of the disease. (Hammond.)

When the extravasation involves both the corpora striata and the optic thalami, as it generally does, there is loss or impairment of the power of motion and of sensibility on the affected side of the body; dilatation or irregular movements of the pupils; impairment or loss of vision (?) and hallucinations of sight and hearing. If the hemorrhage is extensive, it may involve the internal capsule, causing paralysis of the lower part of the face and of the upper and lower extremities, and also implicating the speech tract. The face is drawn to the opposite side; the tongue deviates toward the affected side; there is loss of power in the arm and leg of the same side. The tendon and cutaneous reflexes upon this side, especially the knee-jerk, are temporarily diminished or abolished.

Hemorrhage into the Crus Cerebri.—Produces hemiplegia of the opposite side, more or less extensive, with loss of sensibility. It may also involve the third nerve, thus producing crossed paralysis of the third nerve and body type, or both third nerves and the limbs on both sides may be paralyzed.

Hemorrhage into the Pons Varolii.—There may or may not be loss of consciousness. Convulsions are especially frequent, and sometimes affect the leg only (a characteristic symptom). The paralysis may be bilateral, with loss of sensibility in the part affected. When the lesion is unilateral and in the upper portion of the pons, it produces paralysis of the face and hemiplegia upon the same side of the body and on the side opposed to the lesion. When, however, the lesion is unilateral and in the lower part of the pons, it produces crossed paralysis of the seventh nerve and body type, the face being paralyzed upon the same side as the lesion, while a hemiplegia is developed upon the opposed side of the body. The trigeminus nerve may also be paralyzed; difficult articulation and deglutation; conjugate deviation of the eyes and head toward the side of the lesion; the pupils may be dilated or contracted, according as to whether the lesion of the third nerve is irritative or destructive; respiration is irregular; vomiting is frequent; rapidly rising temperature almost from the onset. If the clot is large, or if the blood escapes into the fourth ventricle, death may result in a few minutes.

Hemorrhage into the Cerebellum.—There may or may not be loss of consciousness; there may or may not be hemiplegia; there may be paralysis of the cranial nerves. Intense persistent vomiting is quite a characteristic symptom; if the patient is conscious, there is usually intense vertigo. A swaying, staggering gait, with a marked tendency to staggering in one particular direction, would indicate a lesion of the cerebellar peduncles. These movements in one particular direction may consist of staggering to one side or backward or forward, or in a semi-rotary movement around a circle, or there may be a tendency to lie on one side. There may be nystagmus and defective power of co-ordination; one eye may be looking upward and the other downward.

If recovery takes place, the pressure effects, including the hemiplegia, pass away, and the only lasting symptom is the cerebellar unsteadiness, which persists in some, but not in all the cases. (Gowers.)

Death may result suddenly from the pressure exerted upon the circulatory or respiratory centers in the medulla, or from the hemorrhage bursting into the fourth ventricle. There are cases on record in which hemorrhage has occurred into the cerebellum, giving rise to no symptoms of its occurrence during life, being discovered only at the *post-mortem.*

Hemorrhage into the medulla usually causes instant death.

Hemorrhage into the occipital lobe, the lingual or fusiform lobule, or the angular gyrus would give rise to symptoms of *hemianopsia.*

Hemorrhage into the posterior portion of the first and second temporal convolutions would cause *word-deafness.*

Hemorrhage into the base of the first frontal convolution or in the neighborhood of the island of Reil would give rise to speech defects (?).

Meningeal Hemorrhage.

In hemorrhage of the cerebral membranes the extravasated blood may be found between the dura mater and the skull, beneath the dura, or in the sub-arachnoidean space. It occurs more frequently in young infants and in old persons than in those of middle age. Trauma is a frequent cause, such as blows on the head, falls, etc.; extreme heat, severe muscular effort, alcoholism, and rupture of an aneurism are also causes.

Symptoms.—If the hemorrhage be due to the rupture of a large aneurism at the base of the brain, the symptoms will be those of apoplexy (which see under " Cerebral Hemorrhage "). In other cases there will be premonitory symptoms, such as headache, vertigo, vomiting, tingling in the limbs, and convulsions, which may be general or unilateral or may affect certain muscles alone.

In some cases there is mental excitement or delirium; in others there is mental dullness. These symptoms are followed by somnolence, which gradually passes into coma. The coma may deepen and the patient die without recovering consciousness, or he may pass out of the comatose condition, be able to speak and to move his limbs, but from a renewal of the hemorrhage again pass into a comatose state. This may be repeated time and time again until death finally results. There is usually paralysis of the limbs on both sides, the cranial nerves also being sometimes involved.

The pupils may be contracted, dilated, or unequal in size. Small meningeal clots upon the convexity of the hemispheres are indicated often by some special type of monoplegia, amnesic or ataxic aphasia, or an impairment of some special sense. (Ranney.)

Infantile meningeal hemorrhage is a name given by Gowers to those cases where the hemorrhage is produced during birth. It occurs more frequently in cases where there is difficult parturition, either with or without the use of forceps, and especially in feet presentation; the head, coming through last, is more subject to mechanical congestion.

The symptoms vary in different cases. In the majority of cases nothing abnormal is observed in the condition of the child in the first few days or weeks of life; then it is noticed that one arm and one leg, or both legs, or all the limbs, do not move; also there may be difficulty in swallowing; or it may not be detected for several months, when it is noticed that the child fails to stand or to walk at the age at which it should begin to do so, or it is unable to support its head. In other cases there may be convulsions, general or unilateral, from the time of birth. These convulsions usually cease at the end of a week or two after birth; the face is rarely involved; the trunk muscles in some cases may be affected. In the majority of cases as the child grows older it shows signs of mental impairment, and in some cases complete idiocy. In many of the cases these mental symptoms improve, but, as a rule, very slowly. In cases where the mental impairment is not too great the child gradually acquires more power over the movements of the limbs, and ultimately acquires some ability to stand and walk, although it may be only at the age of six or eight years. It rarely ever regains complete control over the movements of the limbs, so that a peculiarity of gait may persist through life.

Diagnosis of Berebral Hemorrhage.—It is not always easy to make a positive diagnosis of cerebral hemorrhage during the initial apoplexy. It may be confounded with *syncope, asphyxia, uræmic coma, narcotism,* or *alcoholism,* and in many instances it will require several hours of close observation before a positive diagnosis can be arrived at. When, however, you can get a history of prodromal symptoms, such as headache, vertigo, unilateral numbness or weakness, preceding the loss of consciousness, and following the loss of consciousness a considerable fall in the temperature or a rapid and considerable rise of the temperature within a few hours from the beginning of the attack, and associated with these symptoms there is difficult and irregular respiration (stertorous breathing), the diagnosis of cerebral hemorrhage would be clear.

SYNCOPE.—In syncope the pulse is hardly or not at all felt, instead of being full as it is in apoplexy. The face is pale, and there is a quiet or sighing respiration, instead of a stertorous as in hemorrhage; also no impairment of the reflexes.

ASPHYXIA.—The turgid and livid face, the bluish lips, the distressed and embarrassed breathing preceding the convulsions, and the loss of consciousness show clearly that the disturbance affects the lungs primarily and does not reside in the brain.

URÆMIC COMA.—The coma is not so profound, and is, as a rule, preceded by convulsions; pupils normal or dilated, but *equal;* puffy eyelids, swollen ankles, or there may be general anasarca; absence of paralysis; very little elevation of the temperature; albumen and casts found in the urine.

NARCOTISM.—The coma of opium is not attended with paralysis, and the pupils are markedly contracted. There is likely to be repeated vomiting and a gradual intensification of the coma. The patient, however, unless death be close at hand, can be momentarily roused from a deep sleep; the calm, slow breathing is unlike the stertor of apoplexy.

ALCOHOLISM.—The coma is not so profound as in apoplexy; the pupils are usually dilated, but regular; the eyes are injected; there is no deviation of the eyes and head; there is no paralysis; the breath will smell of liquor, and alcohol may be detected in the urine. All the symptoms become suddenly much ameliorated after the inhalation of ammonia or after the stomach has been emptied of its contents.

APOPLECTIFORM ATTACKS OF CEREBRAL CONGESTION.—The coma is not so profound, and is of shorter duration; consciousness is usually not entirely lost; there is no paralysis; the history shows that there has previously been attacks of the same character, transient, leaving no after symptoms.

In a first attack of cerebral hemorrhage or an attack occurring in a person without his previous history, the diagnosis may be impossible. In apoplectic attacks in general paralysis of the insane the history of the case and the preceding symptoms are generally sufficient to arrive at a correct diagnosis; the attacks are usually of short duration, and the patient rapidly recovers his ordinary state.

The differential diagnosis between *paralysis, thrombosis,* and *embolism* is not always possible, and the remarks at the beginning of the subject will suffice.

In *meningeal hemorrhage* there is headache, delirium, and convulsions, and the affection develops gradually; but where there is a sudden rupture of a large aneurism at the base of the brain, causing an apoplectic condition, it would be impossible to make a diagnosis between meningeal and cerebral hemorrhage.

Prognosis.—The prognosis will vary according to the locality affected and the severity of the symptoms. When the coma is profound, with a very low temperature (96° or 97° F.), or where the temperature quickly rises and the coma has not begun to lessen at the end of twenty-four hours, the case will probably have a fatal termination; also in cases when prolonged or frequent convulsions accompany the attack, and when the pupils are widely dilated. Cases that develop the Cheyne-Stokes rhythm are usually fatal. Bilateral paralysis and acute bed-sores are unfavorable, but not necessarily fatal symptoms. The majority of cases get over the first attack, but are liable to have another within three to five years. Few survive the third attack.

The prognosis as regards the paralysis is bad when contracture supervenes, either early or late. When, however, there is no contracture, and there is some return of movement in the parts paralyzed within three to five weeks, the probabilities are that the patient will regain a moderate control over the affected limb or limbs. Paralysis that is complete at the end of three months will probably remain considerable in degree for the rest of life, except in those parts in which the other hemisphere can compensate for the loss. (Gowers.) When the corpus striatum is entirely destroyed by effusion of blood or softening, paralysis of the opposite side of the body will not only be complete, but also permanent. In cases of paralysis or paresis, however, where only an effusion of a small quantity of blood into the ganglia has taken place, this may in course of time be absorbed, and the patient's health may be gradually restored, As a general rule, better control is obtained over the movements of the lower limbs than the upper.

Treatment.—During the attack of apoplexy the patient should be laid down, but with the shoulders and head well raised. The clothes about the neck should be loosened, and every means possible should be used to cause a contraction of the cerebral arteries. Ice applied to the head will often prove of service. The patient should be kept quietly in bed until all symptoms of reflex disturbance, such as headache, convulsions, delirium, coma, etc., have disappeared; he should be kept free from all mental excitement, and all muscular exertion absolutely prohibited; he should not even be allowed to rise from a prone position. The paralyzed limbs should be kept warm by being wrapped in dry, hot flannel. The diet should be light, but nutritious, consisting mainly of eggs, soup, fish, and milk. The bowels should be kept open by means of enemata of warm water, and the urine drawn off regularly every six or eight hours until the patient becomes able to void it voluntarily. Where there is a tendency to the formation of bed-sores, the use of a water-bed or the judicious use of absorbent cotton so applied as to take off the pressure from those points that show irritation will often prevent their occurrence.

Electricity will prove of valuable service in the treatment of cerebral hemorrhage, both in the earlier and later stages. After an apoplectic stroke, the electrical treatment should be directed first to the seat of the lesion, in order to promote vasomotor and trophic changes; next to the paralyzed muscles, so as to affect favorably the nutrition of the muscles and preserve their physiological activity. The galvanic current acts beneficially by promoting the collateral circulation, whereby the process of softening is prevented, the nutrition of already softened matter improved, the absorption of extravasated blood promoted, œdema and congestion removed, and thus function is gradually restored, either completely or partially. After the first stage, when the active symptoms have subsided and paralysis has developed, the faradic current should be applied to the affected muscles or limb two or three times a week, so as to prevent atrophy. When contractures develop, static sparks should be applied to the contracted limb. Massage may be alternated with the electricity.

When aphasia is present, it may be treated by applying the negative electrode over the region of the third frontal convolution and the island of Reil, the positive to the nape of the neck. The galvanic or the faradic current may also be applied to the muscles concerned in articulation.

For special methods of applying electricity in cases of apoplexy, see the " Electrical Treatment of Paralysis."

Aconite.—Heat of the head; skin more warm than cold; the carotids throbbing, the pulse full, hard, strong, even suppressed but not intermitting. Especially indicated when fright or vexation is the exciting cause.

Arnica.—One of the chief remedies on account of its great power to produce absorption of the extravasated blood, thereby relieving compression of the brain. Arnica is admitted to be the best remedy for hyperæmia consequent upon concussion of the brain by a fall, blow, etc., or by other mechanical compression. It is indicated in comatose, soporous, stupid states where the patient lies as if dead; or there is drowsiness with sighing and moaning; eyes staring or dim; pulse full, strong, irregular, or intermittent; face and head hot, body cool; respiration stertorous; loss of consciousness with involuntary discharges of urine and fæces; bed-sores form very readily; paralysis, especially on the left half of the body; coldness of the lower part of the body with warmth or heat of the upper part; indicated also in cases when associated with hemiplegia, there is aching and soreness all over the body. The remedy is particulary suited to stout, middle-aged, plethoric people, with strong hemorrhagic tendencies.

Apis.—Apis is called for where the coma fails to yield to *opium;* or where the sopor is interrupted by piercing shrieks; where there is a great amount of compression of the brain as indicated by the shrill cry (cephalic cry) which betokens stabbing, piercing pains or excitement. Apis holds a prominent position as a curative agent when there is meningeal irritation.

Aurum.—Aurum is especially indicated in syphilitic cases after the abuse of mercury.

Baryta carb.—In apoplexy occurring in drunkards; apoplexy in old people followed by paralysis, especially of the right side. The patient is childish and has loss of memory; at times anxious and full of fear; trembling of the limbs; inability to keep the body erect; well-marked paralysis of the tongue; breathing short and suffocative; pulse small and irregular. Indicated also in idiotic children; the mouth is kept half open and the saliva runs freely; the child has a silly, vacant look.

Belladonna.—Belladonna is especially useful during the first stage of the disease; also later, when the stage of inflammatory reaction sets in; even though there be stupor still there are evidences of irritation and not wholly depression. There is loss of consciousness; the pulse slow and full; the face is of an intensely deep red or of a livid color; eyes red and staring; pupils greatly dilated; difficulty of swallowing or inability to swallow; labored, irregular breathing with stertor; paralysis of the facial muscles and tongue; the mouth drawn to the right side; paralysis of the extremities, especially on the right side; icy coldness of the extremities.

Causticum.—More useful after the apoplectic stage has passed and the stage of contraction of the paralyzed muscles has set in. Especially called for in paralysis of the tongue, and when deglutition and speech are more or less affected; also when the mental faculties are confused—impossible to find the right word.

Cocculus.—The paroxysms are preceded by drowsiness, vertigo, dimness of vision, convulsive movements of the eyeballs; followed by loss of consciousness; head and face hot, feet cold; pupils greatly dilated or contracted; difficult breathing with or without stertor; pulse small and hard; paralysis especially of the lower extremities.

Cuprum.—Cuprum is of especial value where there are convulsive twitchings of the fingers; paralysis of the lower limbs; twitching in the lower limbs, drawing them backward; weakness of the knees, with painful drawing when walking and standing, which is very difficult; knees give way. Especially useful in the later stages for the pains and cramps associated with the paralysis.

Helleborus.—Especially indicated when the apoplectic attack is followed by great mental impairment; in children, idiocy; the face pale and often cold or colder than natural, and at times livid and covered with a cold sweat; forehead wrinkled and bathed with cold sweat; pupils dilated and the lower jaw tends to drop; chewing motion of the mouth; alternate motion of one arm and one leg; the muscles of the limbs rigid; pulse small and weak and almost imperceptible. Helleborus claims precedence where the irritation of apis gives place to mental torpor, with want of reaction, there being no response to touch or pressure.

Hyoscyamus.—Loss of consciousness accompanied by involuntary evacuations from the bowels and bladder (almost a specific); patients continually touching their sexual parts.

Lachesis.—Vertigo, with rush of blood to the head; vertigo worse on closing the eyes or lying down; drowsiness or sopor and insensibility; anxious and painful expression with stupor; a stupid, drunken look; the face is distorted and blue; blueness around the eyes, and blue lips; a blowing expiration; paralysis on the left side. It is useful for the after effects of an apoplectic stroke when the mind is weakened; the patient is able to think only with difficulty; he has to think how words are spelled.

Nux.—Apoplexy of high livers and a too sedentary life. The attacks are preceded by premonitory symptoms, such as vertigo, buzzing in the ears, headache as if the head would split open or the eyes be pressed out of the head; nausea and urging to vomit; great irritability. Associated with these symptoms there is usually constipation, with frequent but ineffectual desire to stool. During the attack there is stupor which soon deepens into coma; eyes dull and blurred; difficult breathing; accumulation of mucus in throat; dyspnœa and stertorous breathing; retention of urine; paralysis especially of the lower limbs and lower jaw.

Opium.—The attacks are preceded by dullness of sense, headache, vertigo, roaring in the ears and hardness of hearing, sleeplessness and other symptoms of cerebral congestion. These symptoms are soon followed by drowsiness that runs into profound stupor and coma; the face is hot and covered with a cold sweat; pupils are dilated and insensible to light; the face is deep red or a dark red and bloated; respiration slow and deep and as the stupor grows in intensity it becomes heavier and finally stertorous; slow stertorous breathing; foam at the mouth; pulse full, round and slow; trembling or convulsive movements of the extremities; tetanic rigidity of the whole body followed by relaxation and complete paralysis of all the muscles; lower jaw drops; involuntary discharge of urine and fæces; deep comatose sleep with snoring; impossible to rouse the patient; patient continually grasping at his head. (Give apis where opium fails.)

Lycopodium.—The patient lies in a stupor; the eyes do not react to light, and have a fishy look; the lower jaw is dropped and hangs down; tongue seems swollen, and the patient cannot protrude it; the breathing is snoring; accumulation of mucus in the chest causing a rattling as the air goes in and out of the lungs; urine is either passed involuntarily or suppressed; pulse intermittent and rapid.

Laurocerasus.—The coma looks more like a deep, quiet sleep; complete loss of consciousness and sensation; bloated face; cold, moist skin; pulse small, slow, and irregular; pulse scarcely perceptible; convulsions beginning in the face and extending to other parts of the body, and followed later by paralysis; passing urine and fæces involuntarily.

Glonoine.—Glonoine is called for during the prodromal stages, before any extravasation takes place; severe headaches; hot flashes in the head and face; the carotids throb violently, the throbbing being synchronous with every impulse of the heart; oppression of breathing with palpitation of the heart; vertigo; dullness of head; bright spots before the eyes; nausea and vomiting.

Sulphur.—Face pale and bathed in sweat, particularly the forehead; the eyes half open and the pupils react very sluggishly to the light; urine suppressed; also indicated in the later stages when there is paralysis, especially of the legs (paraplegia), with total retention of urine; the urine when drawn with catheter is turbid and highly offensive; associated with the paralysis there is numbness which extends up to the umbilicus.

Sepia.—Attacks preceded by venous congestion; venous apoplexy; headache coming on in terrific shocks; vertigo when walking, with staggering; palpitation of the heart; cold feet; sudden stoppage of the menses. Especially indicated in men addicted to drinking and sexual excess, or women from affections of the genital organs.

Veratrum vir.—Congestive apoplexy; intense congestive headache; fullness and throbbing of the arteries; head hot; the face is red; ringing in the ears; dimness of vision; the eyes bloodshot; violent convulsive twitching; stupefaction; coma.

For further treatment see " Congestion of the Brain " and " Meningitis."

Cerebral Softening.

(*Softening of the Brain.*)

Softening of the brain may follow vascular occlusion from an embolus or a thrombus; or it may be the result of an inflammation of the brain, or may be caused by mechanical compression of some of the cerebral arteries or sinuses. When due to an occulsion of an artery, the collateral circulation may not be sufficient to supply the part, and certain areas of the brain-substance, deprived of their nutrition, lose their functional powers and quickly undergo degeneration. The chief blood-supply of the convolutions being derived from small arterial twigs from the pia mater, each twig not anastomosing much with the others, but nourishing a small convolutional area of its own, if one of these is obstructed its area dies, and softening occurs, slowly or quickly, according to the kind of obstruction. The softened material consists of detritus of brain tissue, in a condition of fatty degeneration with more or less pus-cells or pigment. When such areas are red in color from intermingled blood-cells or pigment, the condition is called *red inflammatory softening* and is commonly an acute affection. When fatty degeneration prevails, and the red blood-cells or their derivatives are not abundant, the softened area looks yellow or yellowish-white, and this is often called *yellow inflammatory softening*, and is usually a subacute affection.*

There is another form of softening, known as the *white* variety, usually dependent upon some disease of the small arteries and capillaries, which gradually deprives the parts of their normal nutrition and is a chronic condition. It was formerly thought that all forms of softening were of an inflammatory nature, but later researches have shown that this was incorrect, for in the greater majority of instances it is simply a necrosis, due to an arrest of the blood-supply.

In the majority of cases the symptoms, in the main, correspond to those of cerebral hemorrhage, the chief points of difference being that in softening the premonitory symptoms, such as headache, vertigo, numbness, and paresis, are generally more pronounced; loss of consciousness is less frequent than in hemorrhage; the coma is of shorter duration, and not so profound as in hemorrhage; the initial fall of temperature is less than in hemorrhage; the period of inflammatory reaction is more pronounced in softening than in hemorrhage; interference with speech is more frequently met with in softening than in hemorrhage; convulsions are more frequent in softening, and so is monoplegia of the arm or face; as a rule, there is a greater degree of mental impairment in softening than in hemorrhage.

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* The appearance of the softening differs in different cases, according to its duration and the sudden or gradual onset of the lesion. When a twig of a cerebral artery is suddenly obstructed by an embolic plug, most of the tissue supplied by it dies at once, a sort of inflammatory process (the "red softening" of the older pathologists) taking place for a few days first. Then it liquefies from the center outward, appearing as a typical "white softening," the process usually tending to spread into the sound tissue; but sometimes, if the dead portion is very small, the débris gets partly absorbed and the tissue round it sacculates, or, in still rarer instances, shrinks together, forming a condensed cicatrix-looking spot. (Clouston.)

When an individual complains of a persistent headache, vertigo, formication and numbness in the limbs, drags the feet when walking, and answers questions slowly and hesitatingly, softening of the brain is to be expected.

Inflammation of the Brain.

(*Encephalitis, Cerebritis.*)

The substance of the brain may become inflamed simultaneously with or independently of its coverings, but the differential diagnosis between encephalitis and meningitis is not always possible since the disease process extends readily from the membranes to the adjacent brain-substance. Rarely is the brain inflamed idiopathically.

Encephalitis is caused by one of three causes: (1) A traumatic injury, as from blows, falls on the head, fracture of the skull, etc. (2) Extension of inflammation from contiguous parts, as from diseases of the external ear or temporal bones, disease of the nasal cavity or of the orbit, and syphilitic diseases of the bones of the cranium. (3) Septic influences, the result of a distant suppuration or a general pyæmia.

The symptoms are, in the main, identical with those of localized meningitis; but if a case presents a history showing that one of the three causes of encephalitis is present, and there is a sudden perversion of the sense of vision or hearing, if there is marked tremor or convulsions occurring on one side, if the coma quickly follows the period of excitement and is accompanied or preceded by one-sided paralysis, the possibilities are that the brain-substance has become involved. "In the form that results from specific blood-state we would suspect that the brain-substance was involved if the cerebral symptoms became more pronounced after the pyrexia." (Gowers.)

The treatment is, on the whole, similar to that of meningitis.

Abscess of the Brain.

An abscess of the brain is the result of a previous inflammation resulting in suppuration. Abscesses within the cranium are comparatively rare. There may be only one or there may be several; they may vary in size from a pea to a hen's egg; in rare instances they may be so large as to occupy the larger part of the cerebral hemisphere. There may be one large abscess with many small ones lying contiguous to it. As a rule, the abscess is single when due to injuries or ear disease; multiple when due to distant suppuration or general pyæmia. In pyæmia the abscesses are usually small, varying in size from a mustard seed to a pea, and are usually located near the surface of the brain. Single abscesses may be situated in almost any part of the brain, but are more frequently found in the cerebrum than in the cerebellum; they are rarely met with in the basal ganglia, pons, or medulla. Abscesses due to ear diseases are almost always found either in the temporal lobes or in the cerebellum. If the ear disease is in the tympanum, the cerebrum is usually the seat of the abscess, but if the disease is in the mastoid cells, the cerebellum is usually the part affected. (Dana.) Abscesses, the result of injuries, are found more frequently in the frontal and temporal lobes. The white substance of the brain appears to be more prone to suppuration than the gray.

The abscesses may or may not be encapsulated. The shape of the encapsulated abscess is usually more or less round, the wall consisting of connective tissue, which becomes thick and tough. The capsule is at first thin and delicate, but gradually increases in firmness and in thickness and has a smooth inner surface. The non-capsulated abscess is an irregular cavity. The walls of the cavity are ragged and infiltrated with pus, and outside of the walls is a zone of œdematous and softened brain-tissue. The contents of the abscesses consist of a thin pus of a greenish tint, usually acid in reaction, inodorous except when pyæmic, and of broken-down and softened brain-tissue. When an abscess has become encapsulated, the contents may become of a cheesy nature, or thick and tough, or even calcified, and remain for a long time stationary.

The abscess may open into the ventricles, the tympanum, the nostrils, or the cavity of the orbit, or a fistulous channel may connect it with the surface of the brain; and where there is necrosis of the bones, it may open externally to the skull. If the abscess is near the pia mater, it may set up a meningitis; if near the sinuses of the dura mater, it may cause thrombosis. (Delafield and Prudden.) Rarely the abscess may burst in the lateral ventricle or in the surface of the brain.

Ætiology.—One of the most common causes of abscess of the brain is chronic ear disease. Another frequent cause is trauma—blows or falls on the head; other causes are caries or necrosis of the skull, encephalitis, diseases of the bones of the orbit or nasal fossa,* suppuration of the lungs, erysipelas of the face or scalp, septic embolism, the result of morbid processes in some other parts of the body, pyæmia, and tubercular tumors of the brain.

Symptoms.—Minute abscesses, the result of pyæmia, seldom cause definite symptoms. In abscesses due to trauma the symptoms resemble those of acute meningitis, which often coexists. In some cases the symptoms of an abscess of the brain may remain latent for months or years, the only symptom being a headache or in some cases slight mental depression, and then suddenly develop grave and alarming symptoms. An abscess may not manifest itself for two or three years after the patient has received a blow upon the head or concussion of the brain. In other cases there may be severe cerebral symptoms, running a rapid course and resulting in death in a few weeks. Pain is one of the chief symptoms, and this pain is aggravated by percussion over the region of the abscess. The pain may become localized in the frontal or temporal regions, or there may be shooting pains darting through the brain from ear to ear. Vertigo and vomiting are frequent symptoms in the earlier

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* Chronic diseases of the nose, either of the mucous membranes or of the bones, and diseases of the orbit have given rise to abscesses in the frontal lobes.

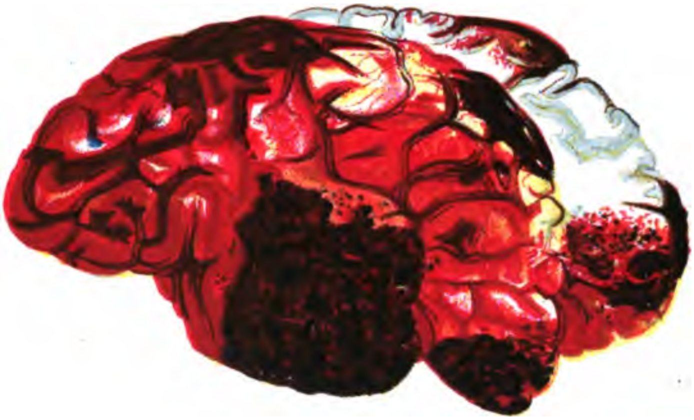
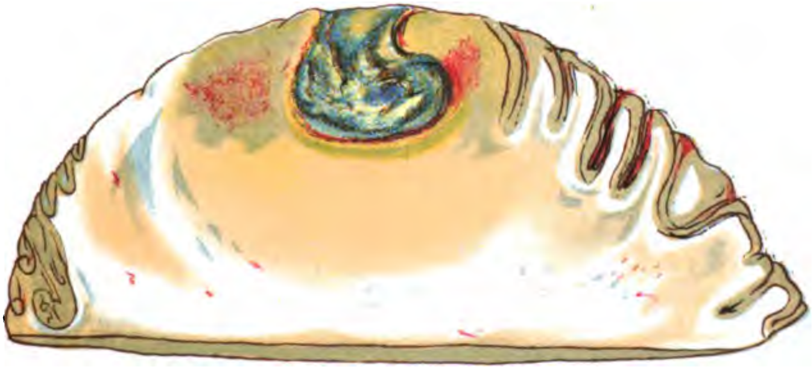


Fig. 69. Plate XIV.—Showing Extravasations in Several Portions of the Arachnoid, with Hemorrhages in Neighboring Portions of the Brain.



H. [illegible], 86-88 Fulton St, N.Y

Fig. 70, Plate XV.—Cerebral Abscess the Result of an Injury.—The injury followed by epilepsy and paresis; death occurring 3½ years after the injury.

stages. The vertigo is not associated with local gastric symptoms, and is usually unattended by nausea. Rigors with paroxysms of fever of irregular intervals should lead us to suspect suppuration when the history shows that any of the causes that are liable to produce cerebral abscesses are present. Rigor may vary from a mere feeling of coldness to the most violent shivering, and may vary in duration from a few minutes to half an hour or longer. The temperature may be normal or subnormal, but usually during the earlier stages it is slightly above normal. The pulse is usually slow (ranging from 60 to 70, though it may be as low as 30) and full, though sometimes weak and soft. *As the abscess grows, the pulse rate shows a diminution.* The respirations also are slow, though usually regular. "They are sometimes as slow as 11 per minute." (Macewen.) Optic neuritis often occurs. The pupils are apt to be irregular. The cranial nerves are usually affected.

In brain-tumor the disks are choked *equally* on *both* sides; in abscesses, *more* on the *affected* side. There may be homonymous hemianopsia. There may be tremor, convulsions, and paralysis. These symptoms (tremor, convulsions, and paralysis) are usually entirely absent when the abscess is located in the temporo-sphenoidal or frontal lobes, as a lesion of these parts of the brain rarely ever produces local symptoms. The only symptoms usually manifested in such cases are an inequality of the pupils, vomiting, and optic neuritis, and with these symptoms there may be rigors. Constipation is the rule, and it is often very obstinate. The urine occasionally is retained and requires to be removed by a catheter. The tongue is generally thickly furred and the teeth covered with sordes. The breath has a foul, putrid odor, resembling that of putrid pus. The patient complains of extreme muscular weakness.

In the last stages there is a gradual deepening stupor, which passes into coma, ending in death. The death may be the result of the bursting of the abscess into the ventricles. In the latter case the temperature quickly rises from subnormal up to 104° or 105° F.; the pulse, from 40 or 50 per minute, quickly reaches 120 and over. All the symptoms in general resemble those of ventricular hemorrhage—convulsions, stupor, coma, etc., and death within a few hours.

Diagnosis.—In many cases, on acount of the latent course of the affection, a diagnosis is extremely difficult, or even impossible; but when there is headache, vertigo, vomiting, fever, rigors, slow pulse, and normal or subnormal and irregular temperature occurring in connection with a cause which is known to be capable of giving rise to a cerebral abscess, such as injury, aural or nasal disease, or distant suppuration, the diagnosis of an abscess becomes more certain.

Prognosis.—This will depend upon the size and the location of the abscess. If small, there is a possibility of its being absorbed. Large acute abscesses, unless dealt with surgically, end in death within a short period, generally within two to three weeks. Chronic abscesses may remain for years. According to Macewen, there is no cerebral affection more amenable to surgical treatment, and none which offers better results. He says that an uncomplicated cerebral abscess, whose position is clearly localized, if surgical measures are adopted for its relief at a sufficiently early period, is one of the most hopeful of all cerebral affections. After aseptic evacuation of the abscess, not only is the patient likely to recover, but in many instances it leaves no perceptible permanent mental or bodily damage. Within a few days (sometimes hours) after the evacuation the mind becomes bright and intelligent, the paralysis passes away, and within a few months the optic neuritis has disappeared, leaving the visual functions unimpaired.

Treatment.—The treatment of abscesses of the brain is preventive and surgical. The first step is to prevent the occurrence of an abscess. Any of the causes that are liable to lead to an abscess of the brain, such as chronic ear disease or disease of the orbital or nasal or buccal cavities, should be closely watched and a free exit secured for the products of the inflammation, for an extension of the disease to the brain rarely occurs as long as there is a free exit for the discharges.

In the early stages of acute abscesses the treatment is similar to that of inflammation of the brain. After pus has formed, then surgical treatment is the only means of affording relief.

Tumors of the Brain.

The brain and its membranes may be the seat of a variety of tumors, differing much in structure. Brain tumors exist either as distinct, circumscribed growths, with sharply defined outlines, or they may be, as it were, infiltrations passing insensibly at their circumference into the surrounding brain-tissue. The brain-tissue around a tumor may be healthy, but usually it is softened to a variable extent. If the growth is large, or if there are many of them, the convolutions may become flattened by the pressure, the bones become thin, and even the structures of the skull may be separated by the powerful distending force.

Any one of the various forms of tumors which invade the other structures of the body, such as tubercular, syphilitic, gliomata, sarcomata, carcinomata, fibromata, osteomata, enchondromata, myxomata, lipomata, angioma, neuroma, and parasitic cysts, may also be found in the brain. But the most frequent types met with are:

1. Tubercular tumors. These constitute more than half the total number of cases. (Gowers.) They occur more frequently in childhood than adults; most frequently between the third and eighth years. The tumors vary in size between that of a millet-seed and that of a hen's egg. The most common size ranges from a large pea to a small walnut. There may be only one or there may be several. The most frequent seat is the cerebellum, and they are more apt to be found in the brain-substance than attached to the membranes. They have an opaque, cheesy appearance. Caseous degeneration is not infrequently encountered in the central portion of the tubercular masses. They are usually separated entirely from the brain-substance, and are readily detached. Occasionally the masses undergo calcification; rarely they may take on a suppur-

ative form. As these tumors grow, the brain-substance becomes compressed and softened, and ultimately atrophies.

2. The next group is the syphilitic growth (*syphilomata, gummata)*. These growths, from a clinical standpoint, are of more interest than all others, because they are more amenable to treatment. They are of an irregular, nodular shape, and vary in size from that of a hazel-nut to that of a chestnut. They are found more frequently in the cerebral hemispheres and the pons Varolii, and are usually attached to the pia mater. They are usually superficial. As they grow the brain-substance becomes softened and more or less displaced, but is not infiltrated by the growth. In consistence they are firm, but not equally so in all parts. They appear as reddish-gray, jelly-like masses, with tracts or spots of cheesy matter. Syphilitic tumors are the result of acquired syphilis, but not of the inherited disease.

3. Gliomata and sarcomata. These types of tumors consist of round, oval, or spindle-shaped cells, with more or less intercellular and fibrous tissues. According to Gowers, the former variety grows by infiltrating without displacing the cerebral substance, and has no sharp outline; while the latter variety does not infiltrate and has a well-marked limit, beyond which the brain-tissue is usually softened, so that the tumor can be easily detached.

4. Carcinomata. Cancerous growths may be primary, but are more likely to be secondary to cancer occurring elsewhere. The growth may be circumscribed, or it may infiltrate the parts of the brain in which it occurs. There may be one or several. They may vary in size, may equal that of an orange or even larger. Occasionally even the greater part of one hemisphere may be implicated. They occur most frequently between the fortieth and sixtieth years.

5. Parasitic cysts may be caused by echinococcii or cysticerci. The former are usually single, the latter are often multiple. They are due to transportation of the embryos from some distant part.

6. Aneurism of the large arteries at the base of the brain constituting the circle of Willis may be sufficient in size to give rise to the symptoms of a tumor; but this is rare.

The remaining types of tumors, the fibromata, osteomata, neuroma, etc., are rare.

Ætiology.—Males are affected more frequently than females. Tumors of the brain occur more frequently between the ages of twenty and thirty. Hereditary influences have an important bearing on the production of tumors of the brain—for example, cancer or tuberculosis; although tubercular deposits may occur during adult life, as a sequel of similar deposits within the lungs or other parts of the body. Gummata are due to syphilitic infection. Trauma may also act as a cause.

Symptoms.—In many cases the symptoms are obscure, and in rare cases they may be absent. In other cases they may be so slight as to have attracted little or no attention. In rare cases the pressure of a tumor has been unsuspected until revealed by a *post-mortem* examination.

There are two sets of symptoms—namely, *general* and *local*. The former are due to the disturbance of the brain as a whole, and are such as headache, vertigo, vomiting, optic neuritis, general convulsions, mental disturbance, etc.; while the latter are due to some local implication of some portion of the brain and afford some indication of the position of the tumor; the chief of these are local paralysis, spasm, and affection of sensibility and the cranial nerves.

The general symptoms usually precede the local, and the onset of both is usually slow and gradual. Headache is one of the most constant symptoms, rarely absent. It is usually continuous, but occasionally there are violent neuralgic paroxysms, with dull aching sensations in the intervals. The pain varies in character from a dull ache to a violent, excruciating pain; it may be a tearing, or a stabbing, or a boring pain; in fact, there are no headaches like those caused by tumors of the brain; they sometimes stupefy and " drive the patient mad." In syphilitic growths the pain is usually more severe than in the other types. If the tumor is superficial, percussion over the area of the tumor aggravates the pain. The location of this form varies. It may be referred to the forehead when the disease is in the cerebellum, or to one side when the disease is on the other. (Ferrier.) When the growth is in the *white substance*, the pain is usually frontal, whether the disease is in the frontal or parietal lobe; but when it is *beneath the tentorium*, the pain is usually occipital, and often seems to pass down the neck. (Gowers.) If the growth involves the trigeminal nerve at the base of the brain, the pain is usually limited to the distribution of this nerve. Bilateral optic neuritis is a symptom met with in the majority of cases affected with intra-cranial growths; this condition is only apparent when the ophthalmoscope is employed, but it possesses a decided clinical value.. Vertigo is a common symptom, especially when the growths affect the cerebellum or its peduncles. Nausea and vomiting may be slight, or they may be so persistent as to seriously endanger life, but are usually present in every case. Convulsions may be both of a general and a localizing symptom. When general, it may be due to tumors in various situations, but especially in the cerebral hemispheres; rarely in the medulla or cerebellum. When localizing, it is due to implication of some particular portion of the motor tract, usually in or near the motor region of the cortex, by the morbid growth, and the convulsion is limited to certain muscles, to one extremity, or to one side of the body. If the convulsion commences in the foot, the tumor is probably in the upper part of the motor region; if in the face, it is probably in the lower part; if in the arm, it may be in or near the middle region. These convulsions are sometimes preceded by a sensation of tingling, "pins and needles," or a pain in the hand or foot, and are usually Jacksonian in character. Common sensations may be impaired or lost. Tact, pain, muscular, and temperature senses may be quite perceptibly diminished. In some cases there is pain and tenderness of the scalp corresponding exactly to the location of the tumor.

As the tumor steadily increases in size one or more of the cranial nerves progressively become impaired; of the special senses there may be impairment of vision, hearing, etc.; of the motor, there may be paresis or paralysis; of the mixed, both loss of motion and sensation. Hemiplegia is liable to supervene as the tumor increases in size.

The mental disturbance in intracranial growths varies. In some cases the mental symptoms may be very mild, barely perceptible; there is some slight impairment of judgment; there is loss of memory; the patient loses interest in subjects which formerly interested him; and there is a tendency to increasing somnolency. In other cases the mental condition may be so severe as to simulate acute mania; there may be hallucinations and illusions, and occasionally acts of violence. In many cases the patient is morose, sullen in manner, and there is great mental depression. In the later stages there may be silly childishness of manner, entire loss of memory, stupidity, drowsiness, general weakness of a paretic character, and even paralytic dementia.

Diagnosis.—Diagnosis is usually not very difficult except in the very earliest stage; however, there are rare cases in which the presence of a tumor was not suspected until revealed by a *post-mortem*. The symptoms, vertigo, a recurring headache, either slight or so severe as to keep the patient awake at night, optic neuritis, the slow and progressive involvement of the cranial nerves, convulsions, paresis, paralysis, and mental changes, all point to an intra-cranial tumor.

Prognosis.—The prognosis, in the main, is unfavorable, unless it should be of syphilitic origin; in that case it is more favorable. In tubercular tumors arrest is not uncommon, and the patient may live on indefinitely. The duration of the disease is usually from six months to two years; cases may, however, continue for an indefinite number of years (ten to twenty).

Treatment.—The treatment will vary according to the nature of the tumor. If tubercular in nature, the treatment given for tubercular meningitis will be applicable. If it is probable or if there is even a possibility that the tumor is syphilitic, anti-syphilitic treatment should be given. Surgical treatment will in many cases prove beneficial. The comparative safety with which the brain may be invaded surgically under antiseptic precautions, together with the certainty of death (excepting syphilitic tumors) from the tumor if not removed, would seem to justify an exploratory entrance into the cranial cavity where tumor had been positively diagnosed, almost regardless of accurately defined localizing data. The symptomatic benefit brought about by relief of pressure is quite often decided and a sufficient justification alone for the relief of the headache, neuritis, etc. Weir, Horsley, Knapp, and others have advocated the puncture of the lateral ventricles and letting out the ventricular fluid; any tender spot being chosen if the seat of the growth is uncertain. If the tumor is beyond the reach of the knife, and of such a nature that it cannot be influenced by remedies, all that can be done is to afford temporary relief.

Cerebral Palsies of Children.

Cerebral palsy is an affection met with quite frequently in infancy and early childhood. There are three forms of palsy—namely, *hemiplegia, diplegia* or double hemiplegia, and *paraplegia.* The seat of the lesion in these cases is in the hemispheres of the brain.

Ætiology.—The vast majority occur in the first three years of life; about one-third of them are congenital. (Dana.) The paraplegiæ are generally congenital, while the double hemiplegiæ usually occur during the first three years of life. (Gray.)

Brain palsies may occur as a result of hemorrhage into the brain or its meninges. They may also be caused by embolism, thrombosis, anæmia, or inflammation of the brain, porencephalus, simple lack of brain-development or atrophy of the brain, injuries as blows and falls, difficult delivery (especially forceps delivery), scarlet fever, whooping-cough, and syphilis.

Diseases and emotional disturbances of the mother during pregnancy are factors in producing the congenital cases. Injuries to the brain causing paralysis may take place before birth as well as afterward. Before birth the brain may suffer lesions which will destroy life after birth. The chief causes, however, are hemorrhage, embolism, thrombosis, and defective brain development.

Symptoms.—The onset in some cases may be by severe convulsions, which may last for several hours, and when these subside it is noticed that the child is paralyzed upon one side. The face is not always affected, and when it is, the upper portion (the eyelids and brow) is not involved. In other cases the hemiplegia comes on without any convulsions. In most instances, whether there are convulsions or not, the onset is attended by severe cerebral symptoms, such as fever, delirium, and coma, and often the child lies unconscious for several days. (Gowers.)

If the child is old enough to talk, it is sometimes noticed that a motor aphasia has supervened upon the convulsive attack. (Aphasia is quite a common result of cerebral palsy.) In some cases the special senses may be involved; there may be deafness, deaf-mutism, defects in vision, or defective smell and taste. The facial expression of children suffering from cerebral palsy is quite characteristic. There is a look of imbecility even in cases which are really not imbeciles. The so called wax-rigidity is absolutely characteristic of brain palsy; it is a feeling on attempting to bend the limb, as if it were made of wax, which, upon being heated, gradually yields to the pressure exerted upon it.

The paralyzed muscles sooner or later undergo contracture, causing various deformities, such as talipes equino-varus or equino-valgus. With this rigidity and contracture there is an exaggeration of reflexes, and foot-clonus in most cases. There is gradual wasting of the paralyzed muscles, but not so marked as in spinal palsies. Electrical reactions are usually normal. Anæsthesia is never observed. Choreic and athetoid movements are met with quite frequently in these cases. Mental defects are very common, and present every conceivable degree, from a slight feebleness of intellect to pronounced idiocy.

Diagnosis.—The diagnosis of cerebral is to be made from the spinal palsy. In the spinal palsies there is no rigidity or exaggeration of the reflexes; there is rapid wasting of the muscles; there is electrical degenerative reactions, and the palsies are, as a rule, paraplegic in form.

In cerebral palsies the history of the onset (convulsions, fever, stupor, etc.), the rigidity, exaggerated reflexes, and involvement of the face and special nerves, would point to cerebral origin.

Prognosis.—The prognosis, as regards complete recovery, is unfavorable; but, as regards partial recovery, it depends upon the degree of contracture, the extent of the paralysis of motion, the mental changes, and the exaggerated tendon reflexes. In some cases the recovery is so great that only a slight amount of inco-ordination remains, and occasionally this is absent. The paralysis undergoes gradual improvement, the face recovering earliest and most, the leg next, and the arm last. The paralyzed limb is usually smaller and shorter than its fellow.

Treatment.—Very little can be accomplished by medicinal treatment in such cases. Such as is called for would be similar to that of "Cerebral Hemorrhage." Electrical treatment will prove of some benefit. If the use of a faradic current is begun early, it is sometimes very beneficial. In these cases it will be found that the muscles can be stimulated by the "static induced" current with much less pain to the patient than by the use of either the galvanic or the faradic current. This is a point that it would be well to remember when treating young children. For further particulars in regard to the electrical treatment of these cases, see "Electrical Treatment of Paralysis." Surgical treatment by craniectomy has proven beneficial in many cases, but yet the general results have not been what was expected of it at first. The conclusions of

Starr ("Annual of the Universal Medical Sciences," 1893) upon the subject are as follows:

1. Hemiplegia, sensory defects, and imbecility occurring with or without epilepsy in children are chronic diseases, incurable by medicinal treatment. Any means which may be legitimately used to save the individual from a life of invalidism and to take the care from the family is to be employed.

2. The pathological conditions producing these symptoms may be either gross defects and atrophies of the brain or an arrest of development in the cerebral cells, without any change apparent to the naked eye.

3. It is at present impossible to determine absolutely the pathological condition present in any given case without an exploratory operation.

4. Such operations are not without danger, but if caution is used in opening the dura and if the operation be made as short as possible, the dangers are avoided.

5. When manifest atrophies are present the operation will produce no result. When the condition is one of arrested development of cerebral tissue, it may prove of service. When clots, cysts, or tumors are found and removed, the chances of recovery are increased. When the skull is markedly microcephalic, from early union of the sutures, the increased space given to the brain by the operation seems to stimulate its growth and development.

6. Epileptic attacks are often reduced in frequency and modified in character by craniectomy. When the opening of the skull remains covered only by the soft tissues, it appears to act as a safety-valve, allowing changes in the intracranial contents to occur without producing pressure on the brain.

7. While hemiplegia, aphasia, athetosis, and sensory defects have been relieved by the operation, it is yet impossible to predict to what extent imbecility may be relieved.

Russel Park reports seven craniectomies with three deaths, two failures, and two cases brilliantly successful beyond all expectations. The two successful cases were of epilepsy with paralysis and imbecility. Horsley reports two such cases; one ending fatally, the other in marked improvement. He expresses himself as decidedly in favor of the operation.

Porencephalus.

Literally speaking, this term means a hole in the brain. This defect may be either congenital or acquired. The congenital form may be the result of an arrested development of the affected part of the brain, or due to an intra-ventricular disease which at a very early period destroyed the part. The acquired form may result from encephalitis, hemorrhage, thrombosis, or an embolism of the brain.

Generally the cavity is found on the surface of the brain; but it may extend down to the lateral ventricles. These cavities may be very large or very small (from a hazel-nut to a walnut, or even larger), and may appear as if cicatricial contraction had drawn the walls together. Instead of cavities, however, there may be absolute loss of one or both hemispheres. These cavities are generally found filled with fluid of a clear, straw-colored appearance or gelatinous in character. In some instances the corresponding part of the cranium projects outward; in others, however, there is a defect in the bone corresponding to the hole in the brain.

The symptoms vary in different cases, according to the size and location of the cavity. There is usually more or less paralysis and contraction of the opposite side of the body. The mental symptoms may vary in degree from slight weak-mindedness to complete idiocy. The spastic paraplegia so often seen in idiots and imbeciles is no doubt often due to this condition of the brain.

Progressive Bulbar Paralysis.

(*Labio-Glosso-Laryngeal Paralysis, Duchenne's Paralysis.*)

This is a disease characterized by progressive wasting and paralysis of the muscles of the tongue, lips, palate, and throat. There are few diseases of the nervous system with a more constant or better pathology than true bulbar paralysis. It may be the result of hemorrhage or an acute inflammation, but the most common cause is a *chronic degeneration* of the medulla, destroying the nuclei of origin of the *hypoglossal* (leading to paralysis of the tongue muscles); of the *accessory portion* of the *spinal* accessory (leading to paralysis of the laryngeal muscles; of the accessory nucleus of the *facial* nerve (thus causing paralysis of the lower part of the face, especially of the orbicularis oris); of the glosso-pharyngeal (resulting in paralysis of the pharynx); and the pneumogastric.

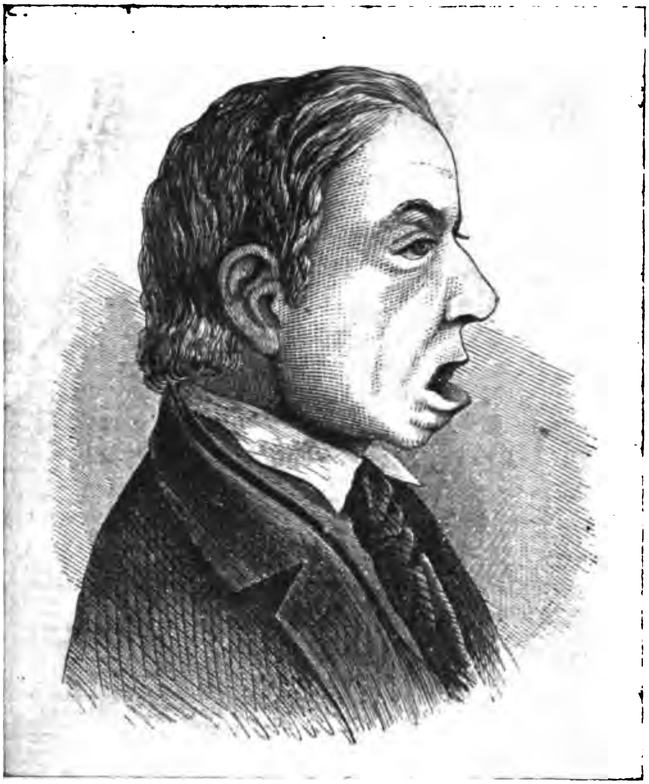


FIG. 71.—SHOWING THE FACIAL EXPRESSION IN PROGRESSIVE BULBAR PARALYSIS. (After Hammond.)

The disease occurs chiefly in the second half of life, rarely in those under forty. The exciting cause of this affection in many cases is obscure. In many cases it appears to be the result of mental depression and anxiety combined with physical exhaustion. Other cases apparently are caused by exposure to cold, a blow on the back of the head, or general debility of the whole system.

Symptoms.—The early symptoms of this affection are vague and indefinite. The patient, some time previous to any well-defined symptoms, complains of pain in the neck and back of the head, neuralgic pains in various parts of the body, muscular spasms, anæsthesia, disorders of the special senses, a feeling of contraction about the chest and breast, and occasionally dyspnœa. Krishaber has noticed a loss of reflex excitability in the pharynx, larynx, trachea, and esophagus, although the tactile sensibility was maintained perfectly. Benedikt claims to have found a valuable diagnostic sign in the condition of hyperæsthesia of the bones of the base of the skull, tested at the orbital roof and the hard palate.

As the disease progresses there is evidence of paralysis in the muscles of the tongue, lips, larynx, and pharynx. One of the first indications of this is manifested by a weakness or loss of control over the finer movements of the tongue. As a consequence of this, there is difficulty in articulation; speech becoming indistinct. The difficulty in speech is soon increased by the weakness of the palate, which ceases to shut off the nasal cavity, thereby causing the voice to have a nasal twang; swallowing gradually becomes difficult. During the act of swallowing the food is liable to be expelled in part through the nose, and it is only with great difficulty that some patients are able to get the bolus of food into the pharynx. At times it enters the pharynx, and, not being carried onward by the muscles of deglutition, may slip into the larynx and occasion suffocation. Liquids are especially difficult to swallow, and are often ejected through the nostrils.

As the disease progresses the orbicularis oris becomes paralyzed and it is impossible to close the mouth; as a consequence of this, the saliva is constantly dribbling out of the open mouth. If the paralysis is complete, the tongue lies trembling and immovable in the floor of the mouth; but if there is only partial paralysis, it can be imperfectly protruded with difficulty, and is tremblingly and slowly retracted. At a later stage phonation becomes impossible, even the power of whispering being lost. The respiratory muscles are liable to become involved, causing an inability to breathe deeply or to cough so as to keep the bronchial tubes free of mucus. When the lips and lower facial muscles are implicated, the facial expression is characteristic of the disease. The naso-labial folds deepen on each side, so that the patient has a woebegone look, the mouth stands wide open, the saliva dribbles from the lips, and the lower part of the face is immobile and devoid of any expression, resembling a cast.

Prognosis.—Unfavorable; death resulting within a few years. As the disease progresses the physical powers gradually fail, death resulting within two or three years from some intercurrent disease (generally broncho-pneumonia, from the entrance of food into the air passages) or the extension of the disease to the respiratory or circulatory centers. Rarely is there ever any mental impairment.

Treatment.—Treatment has very little influence upon the disease; however, in some cases the progress of the disease has been retarded temporarily, but the effect has not been permanent. Electricity has been highly recommended in the form of both the galvanic and faradic current.

Pseudo-Bulbar Paralysis.

This is a form of paralysis having many symptoms in common with glosso-labio-laryngeal paralysis, but differing from it radically in its causation; it has baffled all positive pathological research hitherto, the nuclei of the bulb having been found in such cases to be absolutely intact.

Hoppe ("Annual of the Universal Medical Sciences," 1893, p. 29, A) gives the following diagnostic characteristics of pseudo-bulbar paralysis: (1) Absence of atrophy or electrical change in the muscles affected. (2) Involvement of upper face muscles and oculo-motor nerve. (3) Infrequent affection of the hypoglossal nerve. (4) Distinct remission and sudden changes in symptoms. (5) Negative necropsy as regards lesions of the nuclei in the bulb. He does not believe the disease to be either of hysterical or peripheral origin, but due to a lesion of the cerebrum.

Anderlya records an example of the disease in which a necropsy showed areas of softening almost symmetrically located in the internal capsule and lenticular nuclei of both hemispheres, with some atrophy of the right frontal lobe.

Morton says that a differentiation between a true and a pseudo-bulbar paralysis is not always easily made. In case of doubt, the electrical reactions possess a decisive value. In the pseudo-bulbar paralysis the electric reactions are normal—that is, neither diminution of faradic excitability nor qualitative or quantitative galvanic reactions are present.

FUNCTIONAL AND GENERAL DISEASES OF THE NERVOUS SYSTEM.

A functional disease is one in which the functions of an organ are perverted or set aside, its structures but little changed, if at all.

The term "functional disease" is used in contradistinction to that of "organic disease," which has reference to a lesion of the organ itself, while the former merely concerns the functions of the organ.

A distinct line of demarcation does not always exist between functional and organic disease. A disturbance of function sets up in time disturbance of nutrition, and this in its turn sets up structural change. So that the so called functional diseases must be always regarded as possibly serious, for functional disease long continued may end in organic disease.

Epilepsy.

Epilepsy is one of the chief so called "functional nervous diseases," on account of its frequency and its grave nature. It is called a functional disorder and classed among the functional diseases, but it is hardly possible that a given number of cells can evince morbid tendencies for years and still remain organically normal.

Epilepsy is a disorder, the chief manifestations of which consist in recurring attacks of sudden loss of consciousness, more or less complete, and attended with convulsive movements, which may be either tonic or clonic, affecting one limb or several or the whole body.

Strictly speaking, epilepsy is not a disease, but merely a symptom of disease; but it is considered as a disease for the reason that we are not able to designate with certainty its exact seat, or the nature of the lesion which exists. Epilepsy, according to Hare ("Epilepsy, Its Pathology and Treatment"), is the manifestation of morbid nervous changes and is essentially a cortical disease of the cerebrum, brought about in many ways. Either direct irritation of certain cells may so result, or indirectly by irritation of a reflex character they are perverted from their normal function. The cause of the convulsion is a sudden liberation or explosion of nerve-force in the higher cortical or subcortical centers; instead of working off its course gradually and regularly, it explodes it, as it were.

Epilepsy may be divided into two classes: (1) Organic epilepsy—*i. e.*, epilepsy from recognizable organic disease; (2) idiopathic epilepsy—*i. e.*, epilepsy in which there is no evidence of changes from the normal in the nervous structures when examined.

The organic lesions causative of epilepsy are: Tumors of the brain or spinal cord, sclerosis of the brain and cord, either tubercular or suppurative meningitis, cerebro-spinal meningitis, hemorrhage of the brain, embolism or thrombosis of cerebral arteries or veins, cerebral palsies of childhood, such as hemiplegia, diplegia, or paraplegia, trauma of the brain, peripheral irritations, and syphilis of the nervous system. When all these organic lesions have been excluded, the epilepsy may be said to be "idiopathic." Idiopathic epilepsy, therefore, is a neurosis, like neuralgia, migraine, hysteria, and chorea; the sclerotic and cellular changes that have been found are considered rather as the effect than the cause of the affection.

Ætiology.—Of the predisposing causes, age has a decided influence upon this disorder. According to Gowers, three-fourths of the cases of epilepsy begin under 20 years, and nearly half (46 per cent.) between 10 and 20, the maximum being at 14, 15, and 16.* One-eighth of all the cases commence during the first three years of life, after 20 the annual number gradually falls, but cases commence even in old age (over 70).

Sex is a point upon which different writers disagree; some claiming that females suffer from epilepsy more frequently than males, while others claim the reverse. The concensus of opinion seems to be, however, that up to the age of 30 females are more prone to the disorder, while after that it occurs more frequently in males.

Of all the causative factors, hereditary tendency † is chief. This does not imply that epilepsy necessarily existed in the parents, but that some disease of the nervous system, more or less closely allied to epilepsy, has been present in the parents or grandparents, aunts, uncles, or some other relative. An epileptic parent may have epileptic, idiotic, depraved, maniacal, or melancholic offspring. On the other hand, insane parents may have insane, idiotic, or epileptic offspring. Quite frequently cases are met with in which one member of a family has suffered from epilepsy, while another has been insane and still another idiotic. Reynolds states that in about one-third of the cases under his observation hereditary taint existed. Herpin found that in 68 cases seen by him 10 were descendants of epileptic parents. Echeverria, in his collection of 306 epileptics, found that 80 had hereditary tendencies. In Hammond's 396 cases, 64 had a history of hereditary epilepsy, while 48 had relatives insane, hysterical, cataleptic, etc. Hamilton goes so far as to assert that 50 per cent. of all the 908 cases seen by him were hereditary. In Gowers' 1450 cases there was a hereditary history in 36.6 per cent. Alcoholic habits in the parents may cause hereditary epilepsy. Hereditary epilepsy manifests itself earlier than non-hereditary epilepsy. Another predisposing cause of epilepsy is *profound malnutrition.*

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* Epilepsy, one of the two great derangements of the motor centers (chorea being the other one), is more apt to begin at the period of puberty. The motor centers are more unstable and easily upset in their working in youth than either the mental, sensory, or trophic centers.

† The majority of writers are opposed to the marriage of epileptics, for the risk which the parent runs of transmitting this terrible disease to the offspring is so great that they should be warned against marriage. In Denmark this matter has become the subject of legislative interference, and the fact that one party to a marriage was an epileptic prior to the marriage, without the knowledge of the other, constitutes a valid ground for divorce. (Putzel.)

Among the exciting or direct causes of epilepsy are fright, teething of children, injuries, as blows and falls on the head, mental overexertion, indigestion, sunstroke, scarlet fever, measles, menstrual derangements, venereal and sexual excesses, diphtheria, malaria, pregnancy, chronic alcoholism and chronic lead-poisoning, peripheral irritations, etc.*

Of all the diseases which may result in epilepsy, either by hereditary taint or by acquirement, syphilis, as everywhere, stands prominently in the foreground. This disease may produce epilepsy in two ways: either by producing morbid brain-growths (a meningeal growth or chronic inflammation) or by so influencing the cells of the cerebrum as to cause epileptic convulsions. It usually makes its appearance during the second stage of syphilis. Fournier believes that this syphilitic poison of the secondary stage has a direct action on the nervous system, and may cause pure neuroses, epilepsy among the number. In many cases of epilepsy no cause, either predisposing or exciting, can be assigned.

Symptoms.—In the greater majority of cases of epilepsy the symptoms come under one of two types: ***grand mal,*** the severe type, in which consciousness is totally absent during the convulsive state; ***petit mal,*** the mild type, in which there is momentary unconsciousness with or without marked spasms. These two forms, although clearly distinguished in their general character, are not separated by any sharp demarcation.

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* Many cases are on record where the epileptic attacks ceased with the expulsion of a tapeworm.

GRAND MAL.

In typical cases of grand mal the attack frequently begins without any warning. The patient, while engaged in his ordinary occupation, suddenly loses consciousness, his face grows pale, and at times he utters a peculiar inarticulate cry. He then falls as if struck by a heavy blow; this is followed by a tonic spasm of all the muscles of the body; the limbs become fixed and rigid, the muscles of the hands contract and draw the thumbs firmly into the palm, and the fingers are clenched; the head is either drawn backward or there is deviation of the eyes and of the head toward one side; the jaws are locked one against the other, and the lower jaw may also be drawn away from the median line of the face in the same direction as the eyeballs; sometimes the whole body is rotated, even two or three times; at the same time the muscles of respiration, including the diaphragm, are similarly affected and impede the act of breathing. The tonic spasms of the muscles of the face often produce hideous distortions of the features, in some cases bringing about the so called "*risus sardonicus.*" The face becomes dark and cyanosed, the eyes become fixed, the conjunctiva invisible, and the pupils widely dilated. This tonic spasm lasts from ten seconds to one minute, and is then followed by clonic spasms. These clonic convulsions are at first mild and localized, but quickly become more diffuse and violent, until the whole body is involved in a continual state of violent muscular contraction and relaxation. The limbs, head, face, and trunk are jerked with violence, and during this period the tongue, which has been protruded by the violence of the muscular action, is frequently caught between the rapidly closing jaws and severely bitten.

The face, which had begun to grow dark during the latter part of the tonic stage, now becomes dusky and livid, the eyes are fixed, the teeth are ground together, excessive movements of the muscles of mastication force the increased quantities of liquid secreted by the salivary glands from the mouth in the form of froth, which is often stained with blood by reason of the injuries to the tongue. The features are disfigured by terrible grimaces and contractions. There may or may not be evacuation of the contents of the bladder and rectum.

After the convulsive stage has lasted from a few seconds to several minutes (five or six), the spasms gradually grow milder and less frequent, the cyanosis passes away, the pulse becomes stronger, the respirations become less labored, and finally, the spasms having ceased, the patient passes into a deep sleep or coma, which lasts a variable length of time (a few minutes' to several hours' duration, and has been known to continue forty-eight hours) and from which he cannot be aroused except very rarely, and then with great difficulty.

After the attack, the patient usually wakes feeling dull and heavy, complains of headache, and has a tired, aching feeling in the muscles, as if he had been engaged in some very heavy work. After a severe attack, there is loss of reflex action in the limbs for a few seconds, but the temporary loss is soon followed by an exaggeration of the reflexes, so that the knee-jerk is excessive and the foot-clonus may sometimes be obtained.

Occasionally vomiting occurs after an attack, and may prove of serious consequence. on account of the liability of food to get into the larynx while the patient is in a state of insensibility. Gowers mentions a peculiar symptom met with quite frequently—namely, excessive hunger after an attack, and the patient who has had a hearty meal before a fit will eat another directly after the fit.

During the attack, in fully developed cases, the mental faculties are completely suspended; the patient cannot remember anything that happened during this time.

Every paroxysm does not present the same phenomena or run the same definite course in every case as just described. The onset of the attack may not be so sudden; the attack may be preceded several hours or even days by premonitory symptoms, so that the patient can always foretell the occurrence of a convulsion. It may be manifested by a change in the disposition; he becomes gloomy, sullen, or irritable; or there may be vertigo, flashes of light, or sudden blindness; a duskiness of the skin, especially affecting the face and neck; headache, noises in the ears, a feeling as if the ears were stopped up with cotton; sensorial illusions of various kinds may be present; also mental excitement is observed at times; twitching of certain groups of muscles, as of the eye, or facial muscles, or jerking of the limbs; palpitation of the heart and a sense of distention of the abdomen; attacks of diarrhea or vomiting. In very rare instances sudden spasms of the face and chest occur, with arrest of respiration, and with a subsequent clonic convulsion, yet with so little unconsciousness that it remains doubtful whether the paroxysm has been attended at all with unconsciousness.

The onset of the attack is often preceded by a peculiar symptom, known as the "aura," which forewarns the patient of an approaching attack and allows him to procure a safe position before it occurs. The nature of this aura will be discussed further on.

Every attack of grand mal does not present as marked symptoms as the typical type just described. In some varieties the symptoms are of a milder form; there may be more or less complete loss of consciousness, but without the utterance of a cry or foaming at the mouth; there is no spasm of the laryngeal muscles and no cyanotic condition. In other cases the patient falls unconscious, is rigid for a few moments, and the attack passes off without any convulsion.

PETIT MAL.

The lightest form of epilepsy is known as "*petit mal.*" In this form the patient suddenly stops what he is doing for a moment or two, and then, as soon as he recovers, takes up his work or subject at the point where he ceased, being often unconscious of the break in his conversation or labor; or, again, the patient is walking in the street, when suddenly he stops, stares into vacancy, mumbles a few words, regains his normal condition, and then goes his way totally unconscious of anything unusual having happened; or, again, in conversation, he stops in the middle of a sentence, grows pale or red, the eyes and countenance having a set expression, and then, after a few seconds, continues the conversation. In many patients the loss of consciousness is preceded by some warning sensation, and it is from this circumstance that the minor seizures are so often termed "sensations"; these are the only symptoms of the attack of which the patient is aware, he not being cognizant of the succeeding unconsciousness, so that a very important point in obtaining the patient's history in cases of petit mal is to discover the presence or absence of sensations described by him as "faints," "turns," "giddiness," the nature of which is often not recognized by the patient or his friends.

Gowers gives the following as the chief characteristic features of petit mal:

1. Sudden momentary unconsciousness, or "fainting" or "sleepiness" without warning.
2. Giddiness.
3. Jerks or starts of the limbs, trunk, or head.
4. Visual sensation or loss.
5. Mental state; sudden sense of fear, etc.
6. Unilateral peripheral sensation or spasm.
7. Epigastric sensation.
8. Sudden tremor.
9. Sensations in both hands.
10. Pain or other sensations in the head.

11. Choking sensation in the throat.
12. Sudden scream.
13. Olfactory sensation.
14. Cardiac sensation.
15. Sensation in nose or eyeball.
16. Sudden dyspnœa.
17. General "indescribable" sensations.

After the attack is over, the patient may be at once as well as usual. In some cases, however, he is dazed and stupid for a few minutes, and sometimes performs in an automatic manner some action of which he afterward retains no recollection; such as to undress himself, or perform some difficult feat without accident; sometimes he takes articles or any object which may be near, irrespective of its ownership. Occasionally this stage is attended by passion and violence; he strikes his dearest friend without cause. This condition or state is not merely of clinical interest, but also of medico-legal importance, for without doubt many crimes have been committed while the patient was in this state. Other cases, instead of presenting such automatic action, pass into a state of violent hysterical convulsions. Gowers calls attention to another post-epileptic action, which is automatic, and is important on account of its danger; that is a tendency to turn over on the face; and, if the patient is in bed, suffocation may easily occur during the comatose sleep that follows. Without doubt, many epileptics have died from this cause.

STATUS EPILEPTICUS.

Another severe form of epilepsy has been carefully investigated and described by Charcot, and more recently by Bourneville, under the name of *status epilepticus*. It presents the following characteristics: (1) Rapid succession of attacks; the patient no sooner comes out of one convulsion than another one begins, until finally they follow one another in such rapid succession that consciousness is not restored between the attacks. (2) A variable degree of collapse, which may deepen into the most profound coma. (3) More or less complete and permanent hemiphlegia. (4) Increased acceleration of the pulse and respiration; and especially a marked elevation of the temperature, which persists even during the brief intervals of the paroxysms. The temperature begins to rise from the very beginning, and may quickly reach a height of 108° or 109° and upward. (5) The pupils are dilated either equally or unequally, and do not react normally to light.

The duration of these severe attacks may vary from three to nine days. According to Rosenthal, more than one-half of these cases terminate fatally.

PROCURSIVE EPILEPSY.

The disease is one characterized by attacks which, in the majority of cases, consist in a straight or circling run of a variable distance; other patients spring up and jump about the room a few seconds. This form of epilepsy is rarely followed by a fall or coma; it may alternate with ordinary epilepsy, or precede or merge into it.

JACKSONIAN EPILEPSY.

This is a form of epilepsy due to irritative lesions (generally of syphilitic origin) of the cerebral cortex, manifested by convulsions, which are followed by a transient attack of paralysis. In a typical case of Jacksonian epilepsy, the spasm always begins in some peripheral portion of the body, most frequently the muscles of the thumb or hand; this one muscle or group of muscles may alone suffer throughout the entire attack. In other cases, however, beginning in some peripheral group of muscles, it soon involves other groups, as the entire arm, leg, etc.; or, in still other cases, the entire body may be at last convulsed. Consciousness may or may not be lost; rarely lost, however, when the spasm is confined to localized groups of muscles.

REFLEX EPILEPSY.

According to Hare, the term "reflex epilepsy" is used to signify a convulsive condition in every way similar to the ordinary epileptic convulsions, but which arises by reason of nervous irritation occurring not primarily in the higher motor centers, but in the peripheral nervous apparatus, such as that caused by the involvement of certain nerve filaments in a cicatrix or by an inflammation of any of the peripheral organs. Further, he says that the mere temporary irritability of a cicatrix does not throw the patient into convulsion after convulsion immediately, but the convulsive condition, having been once begun by such a cause, may be brought back, even when no irritation longer exists of an acute form, by some central disturbing mental condition entirely separated from the periphery; and that the law may be laid down as an almost unvarying one, that *every nervous act is followed by other similar nervous acts* (that is, the very occurrence of one nervous act predisposes to a similar act at some future period), rapidly or slowly, according to the severity and frequency of the first act; and if this predisposition be once set up, the subsequent acts may readily be excited by agents which primarily would have produced no effect.

Fere, upon this line of thought, states that the ordinary convulsions of children, the convulsions of scarlet fever, or the eclampsia of pregnancy may end in the establishment of epileptic convulsions.

The question is often asked, Why does the removal of the peripheral irritation in many cases cure the disease, while in others it apparently has no effect? Hare answers this by saying that in those cases cured the peripheral lesion has not existed long enough, or been violent enough, to produce such changes in the central nervous system as to place it beyond the realm of recovery, and that in many instances where the removal of an irritation fails to produce a cure it is the lateness of the operation; too great a central change has been produced to be remedied by Nature's power. Very commonly, however, the removal of the irritation is not followed by an immediate and complete remission of the seizure, but they occur at more and more irregular intervals until they cease, showing that a central change or a tendency to a convulsive explosion must have been set up. The fact already stated must be remembered—namely, that the very occurrence of one nervous act predisposes to a similar one at some future period.

LARVATED EPILEPSY, OR MASKED EPILEPSY.

This is a form of epilepsy where a mental explosion takes place, instead of an ordinary epileptic fit. A very curious disturbance of the memory is manifested in the condition known as *double* or *alternating consciousness—i. e.*, the mental life of two distinct individuals seems to alternate in one person. A person passes through alternating phases of existence of days' or weeks' duration, remembering while in one phase the experience of that phase and of the other phases of the same set only.

Speaking of this condition, Tuke says: "Thus, after a hystero-epileptic attack, a person awakes with a changed disposition, and with total forgetfulness of her past life; and in this phase, which we will call A, she remains for a few days or weeks. At the end of this time she has another similar attack, on emerging from which she is found to have resumed her former character, and to remember only the experiences previous to entering the state A. After a variable interval, another attack supervenes, and she again emerges into state A, remembering the occurrences of the former state A, and oblivious to the rest of her life; and these alternations may occur a number of times." While in this state or condition, an epileptic may commit a crime, being unable to control himself, his mind being in much the same condition in which his body is when seized by epileptic convulsions, and quite beyond his control. He may, while in this state, have a tendency to steal everything that he can get his hands on;

may steal things altogether undesignedly, things useful and things useless; or he may wander from home and find himself long distances from where he started, without knowing how he got there. This condition may alternate with true epilepsy, or eventually take its place.

NIGHT TERRORS OF CHILDREN.

In instances, these night terrors of children are but an evidence of nocturnal petit mal. In many cases, of course, children do have " nightmare " from indigestion or a fright experienced during the day, but these are only occasionally affected, and the attack is of a much milder degree than that of *true* night terror. The child, going to bed apparently in its usual health, falls asleep, to be aroused by or before midnight in the most fearful state of alarm and terror; it shrieks and screams; starts back as if in the presence of some ghastly spectacle; retreats into the arms of its mother; its eyes are wide open, pupils dilated, face flushed and hot, and its features presenting an expression of intense fear and alarm. The final history of the greater majority of such cases is that of epilepsy proper.

The Aura.

One of the most interesting and important of all the symptoms described is the so called *aura*. The word *aura* (vapor) originated with the old Greek theory that the fit began by the ascent of a vapor up the vessels of the limb. In later times it was imagined that the nervous impulse causing the spasm arose in the spot where the aura first appeared, from the fact that a ligature around the limb would arrrest the aura. This view of the case has been proven erroneous, for the onset of an attack can be arrested by means of the ligature where the convulsions are due to brain tumors, showing that the aura is merely the effect on consciousness of the commencing discharge in the brain. According to Charcot and Gowers, some form of aura is met with in about half the cases of epilepsy. In the other half the loss of consciousness always occurs so early that the patient is unconscious of the onset of the attack.

The seat of the aura as well as the sensations constituting the aura varies in different individuals. By far the largest number of cases where it is present have it in an extremity. It may begin as a spasm, or a sensation, or both. The motor aura consists either of muscular contractions or paralysis, which usually affects one limb or even the whole side of the body. At times, also, the muscular twitchings may begin in the face; sometimes the patient performs rotary movements, or even walks or runs a few paces before the convulsions develop. When a sensation, it is usually described as a numbness or as a tingling sensation, beginning in the thumb, hand, or (less frequently) foot, which passes upward, and when it reaches the head consciousness is lost; or it may consist of painful sensations, starting in some part of the trunk or limbs, and rising rapidly to the head. In a patient of mine the aura consisted of a numbness or tingling sensation; beginning in the left foot, it passed rapidly upward to the epigastrium, stopped an instant, and then passed to the head, when it was lost in the sensation of a loud sound, like that of a pistol-shot, followed by a momentary sense of deadly fear and loss of consciousness.

A very frequent sensory aura consists of a feeling of cold or of heat, or of trembling and indescribable distress in the epigastrium or lower down in the abdomen, which rises rapidly to the throat, and as soon as the sensation reaches the throat or head, unconsciousness supervenes. Hart calls attention to a very curious fact in regard to the abdominal auræ—namely, that when *pain* is felt in the epigastrium it never ascends to the head, but remains in this region till the convulsion comes on; whereas, if the sensation is not one of pain, it frequently extends to the cerebrum. In other cases the aura consists of various cardiac sensations, such as palpitation or pain, or a vague discomfort; or, again, a sensation such as that produced by a slight feeling of hunger, of anxiety, or an intense feeling of alarm and terror.

In the aura associated with the nerves of special sense, the most common perversion of function has been found to be that of sight, which, according to Gowers, is twice as frequent as all other special sense auræ put together. It may consist of a single color, or, more commonly, of many, floating before the eyes. Red and blue are the most frequent. No other color is seen alone, and both are never absent. Or it may consist in the sudden diminution or increase in the size of all surrounding objects, or a sensation of a flash of light or of spots; it may be a sudden loss of sight. In other cases the convulsion is preceded by peculiar hallucinations; he sees beautiful places, or ugly faces, or animals. Watson relates a case in which the patient always, when he had a fit of epilepsy approaching, fancied that he saw a little old woman in a red cloak, who came up to him and struck him a blow on the head, consciousness immediately afterward being lost. Kiernan reports the case of an epileptic who always had, as an aura, the vision of a devil attacking him with a pitchfork; the instant this reached him he became unconscious. Auditory warnings are met with quite frequently, such as buzzing or roaring noises in the ears, ringing of bells, crashing or whistling, which grow louder and louder until the patient falls; or, instead of these, there may be a sudden loss of hearing—a strange stillness for a moment before consciousness is lost. In other cases there are sounds of drums beating, fifes playing, etc., but rarely pleasant music. Olfactory auræ are met with occasionally. Sometimes the subjective odors are agreeable, but more frequently they are of a disagreeable nature. Generally they consist of a "sulphurous," "fetid," or indescribable smell, or a peculiar stench. Gustatory auræ are rare; when present, they consist of a sour, bitter, or metallic taste.

Psychical auræ may be present in some cases. These may consist of an intense feeling of alarm and terror or a peculiar, indescribable feeling in the head. In other cases they may consist of illusions, hallucinations, or delusions. While in this state the patient may commit a crime in imaginary self-defense, but of which he has no recollection. In still other cases it consists of a vague, dreamy state.

Cephalic auræ consist of giddiness, vertigo, and sometimes nausea, pain, and heaviness of the head; sensation of rushing of blood to the head; sensation of heat or cold, either within or without the skull; a sudden sense of somnolence.

The so called " epileptic cry " is probably due to narrowing of the glottis at the moment that the air is expelled from the chest by the tonic spasm. As a rule, the patient is not aware of the cry. In some instances it is so low that it cannot be heard at a distance of more than a few feet, but at other times it is extremely loud; it is not observed in more than half the cases.

The epileptogenic zone is a zone or area of skin whereby a touch or pinch produces an epileptic convulsion.

The stage of coma may be immediately followed by a condition of mania (see "Epileptic Insanity"); or this may not occur until the lapse of two or three days. After a severe epileptic attack there may be a slight or a considerable amount of paralysis (usually a hemiplegia), which may continue for a longer or shorter period.

The mental condition varies greatly in different individuals; it may be entirely normal. Some of the greatest men that ever lived, *i. e.*, Julius Cæsar, Mohammed, Napoleon, Newton, Petrarch, Peter the Great, and many others were afflicted with the disease without showing any mental impairment; but in the large majority of cases, however, impairment of the mental power is the rule. The degree of mental impairment varies; every grade of defect may be met with, to actual imbecility. One of the first mental signs is loss of memory; they are unable to collect or concentrate their thoughts; later the intellect suffers generally, and there is often defective moral control. They are eccentric, suspicious, ill-tempered, quarrelsome, fault-finding, fretful, and difficult to get along with. There are two marked mental symptoms that are so common as to be almost characteristic of this affection—namely, irritability and impulsiveness.

In the interval between the seizures the patient is not, in reality, well; his temper is irritable, and his mental faculties slowly but certainly deteriorate. (Intellectual deterioration is associated more notably with petit mal than grand mal.) Dementia is not an unusual complication of long-continued epilepsy; in fact, most epileptics tend to become demented if they live long enough. The general appearance of confirmed epileptics is often characteristic. The cheeks are puffy, lips thick and prominent; the eyes have a peculiar dull, staring look; the features have lost their refined expression, the lower nature of the individual becoming more apparent.

The General Condition of the Patient.—Sooner or later, in the larger proportion of cases, the health suffers to a greater or less extent. There is usually a dull headache, usually in the frontal region. The pain may or may not be continuous. In some cases, however, there is an intense continuous pain, which is usually situated in the occipital region. Many cases are troubled with tremors of the arm or leg. The tongue is usually coated, and the patient complains of a bad taste in the mouth and of an oppression in the epigastrium after eating. The appetite varies, the patient sometimes having a voracious appetite. The bowels are usually constipated.

Course of Epilepsy.—The disease may commence by slight attacks, which may exist for months or years before a severe convulsion occurs; but in the majority of cases the severe type is developed: in other cases the disease commences with a severe fit. The interval between the attacks varies. They may be daily, weekly, monthly, or in some cases years may elapse between the attacks. In some cases there may be several attacks close together, and then there is an interval of freedom. In minor attacks the seizures may be daily, varying from two to twenty a day. Gowers speaks of a case in which there were two hundred a day. Epileptic attacks may occur only during the night when the patient is asleep (nocturnal epilepsy), only during the day when the patient is awake, or in both conditions. They occur more frequently during the day than the night.

Pathological Changes and Pathology.—The pathology of epilepsy is very obscure. There are innumerable brain lesions of almost every kind in different cases; again, in other cases, the most careful examination fails to find any special lesion or abnormality, so that at the very beginning of the study we are forced to acknowledge that no primary changes of an anatomical character can be asserted to be pathognomonic of epilepsy. Some investigators have claimed that epilepsy was due to cranial asymmetry or malformation. Baume states that the weight of the hemispheres in epilepsy is always unequal, the lightest hemisphere being on the side opposite the convulsed portions of the body; yet no one would claim that cerebral asymmetry causes epilepsy, for these changes from the physiological type are entirely secondary to the disease, or have no connection therewith whatever. Dercum (quoted by Hare) has published an interesting paper on the brains of twelve epileptics. In all of these brains abnormalities of the sulci and gyri were found, and in several thickening of the skull was also present.* In some of the brains there was overdevelopment of the occipital lobe, with abnormal sulci. In several others the parieto-occipital and inter-parietal sulci were confluent, producing an arrangement similar to that of monkeys. In a number of cases the fissure of Rolando opened into the Sylvian fissure. In two of the brains the cuneus and in another the lobus quadratus were enormous. In one case an entirely abnormal sulçus traversed the first temporal gyrus. While in nearly every one of the twelve cases there was evidence of mechanical hindrance to the brain development; there were also pathological changes going on. Sommer found a sclerotic condition of the *cornu Ammonis* in the greater majority of the cases he examined. Charcot has found that sclerosis of the hippocampal folds often existed in epileptics. Bevans Lewis has found degenerated changes in the cells of the second layer of the cortex, and in some cases affecting all the layers. Harold Holm has found, in microscopical examination of the brain of three epileptic patients, degenerative processes in the cortical substance, extending to the psycho-motor centers, and even to the medulla oblongata of the spinal cord. All these numerous changes have been met with in other cerebral diseases, and must be considered rather as the effect and not the cause of epilepsy. Various other morbid changes in the brain and its meninges have been found, such as effusions, hardening, softening, thickening, embolism, extravasated blood, etc., but precisely the same morbid appearances have been found in other cases that have never suffered from epilepsy; moreover, in some instances, in confirmed epileptics, *post-mortem* examinations have revealed none of these abnormal conditions.

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* Considerable thickening and sclerosis of the cranium is met with in many cases, and not unfrequently constitutes the sole (of which no explanation has as yet been given) anomaly.

The older writers claimed that the medulla oblongata was the portion of the nervous system most concerned in the production of epilepsy, and that epilepsy was due to vasomotor spasms of the vessels of the brain, producing cerebral anemia; but the investigations of later writers have demonstrated that epilepsy in a large number of cases, if not in all, is due to direct or indirect excitation of the cortex or of the nerve-strands leading from the cortex to the peripheral structures. As proof of the fact that the discharge in epilepsy begins in the cortex of the cerebral hemispheres, Obeke and Gowers both cite cases in which a lesion occurring in the internal capsule prevented the appearance of any more nervous disturbances—at least, on the opposite side of the body from the capsular injury. Such cases show that the discharge causing the general convulsions occurred above the internal capsule—that is, in the cortex of the brain.

The character of the auræ indicates generally the region of the brain affected, and they may be used as the means of localizing lesions during life; for example, an aura consisting of blindness may point to involvement of the centers governing or connected with vision or situated near by; if the aura is in the hand or leg, the hand or leg centers are involved.

The primary cause of the nervous discharge or explosion which produces the aura is not known. The nerve-center may be regarded as an accumulator in which nervous energy is stored, to be given off evenly and regularly on due external stimulus. In epilepsy, on account of nutritive molecular changes in some part of the nervous center, the nerve-cells are in a condition of unstable equilibrium which renders them liable to explode and to liberate their energy irregularly. As has been said, we do not know what starts the discharge; but whatever the condition is, there seems to be a uniformity as to its origin, for in the great majority of cases the symptoms repeat themselves exactly.

As has been said, epilepsy is only to be considered as a symptom which may arise from an almost endless variety of changes in the brain—vascular or structural, and is indicative of a molecular or nutritive disease, a natural inherited defect of development, or the result of universal strain in the course of growth and life.

Epilepsy is extremely closely allied to nervous insanity, and is but one branch of the nervous tree.

Diagnosis.—As a rule, no difficulty is experienced in recognizing true epilepsy (grand mal) where it occurs during the day, and where there is a history of repeated epileptic convulsions occurring spontaneously, and not accompanied by any other cerebral symptoms. But mistakes are readily made, even in cases of grand mal, when the convulsions occur only at night, and do not awaken the patient; he may sleep on when it is over, and be unconscious of its occurrence. Nocturnal attacks may occur for years without the patient or his friends suspecting the attack. Nocturnal incontinence of urine in the adult should always arouse our suspicions in this direction. If, in addition, the patient complains of a headache, of being worn out in the morning, and feeling "as if he had been working all night," if the tongue feels sore and the pillow is stained with a little blood, an extravasation beneath the conjunctiva, ecchymoses in various portions of the face—when all these symptoms are met with, they are strongly indicative of nocturnal epilepsy. In cases of petit mal the initial seizure, such as faintness, dizziness, etc., may pass unrecognized for some time by the patient and his friends, on account of not understanding their true significance.

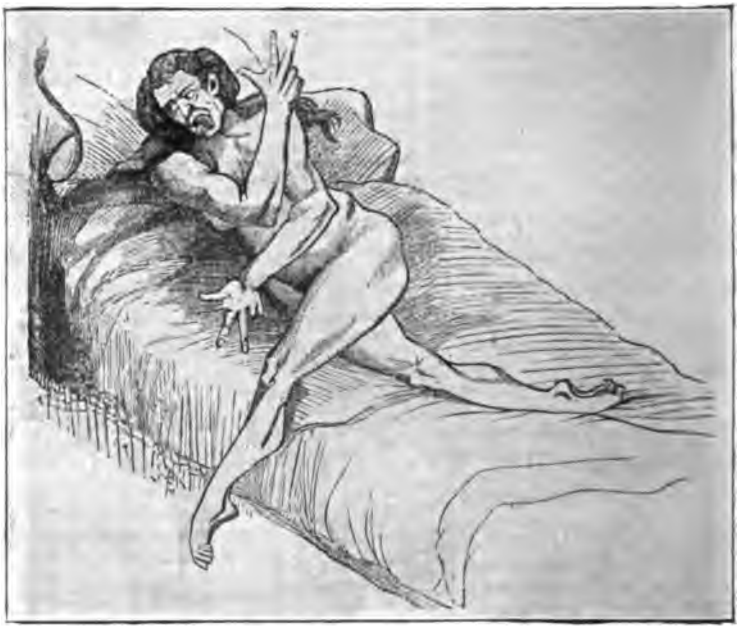

FIG. 72.—POSTURE IN HYSTERO-EPILEPSY.

An affection with which epilepsy is most liable to be confounded is the convulsions of hysteria, commonly known as "hystero-epilepsy." This condition is characterized by peculiar combinations of the symptoms of hysteria and epilepsy.

Epilepsy and hysteria as distinct diseases may for a time coexist in the same patient; but the term "hystero-epilepsy" is applied only to those cases in which the paroxysms consist of both hysterical and epileptic symptoms combined, and not to those in which hysteria and epilepsy are associated as distinct diseases, each being characterized by its own peculiar symptoms. In hystero-epilepsy the attacks occur more frequently during the day; consciousness is not lost during the attack, but is, at most, slightly disordered; nor does coma often develop after the attack; the convulsive movements do not present the same regularity preserved in an epileptic seizure; the patient throws herself into peculiar positions, as of the crucifix, or intense grief, or perhaps immoderate laughter, with corresponding movements of the trunk, or rolls around from one place to another; respiration is not so completely interrupted, and the entire attack may last from several minutes to an hour or more, and usually terminates by hiccough, weeping, or the passing of excessive quantities of pale urine, and is often followed by motor and sensory disturbances. Hysterical convulsions may often be modified or arrested by energetic pressure over the ovary, a phenomenon which is never observed in epilepsy. A rapid succession of hysterical seizures may be readily diagnosticated from status epilepticus by the fact that the latter is attended by rapid rise of the temperature, while the former is never accompanied by this symptom. Hallucinations are far more common after an hysterical attack than in epilepsy, and sometimes they occur even during the attack. Females are more subject to hysterical attacks; males rarely ever. In hysteric spasms the thumbs are never clinched; the eyes, although sometimes staring, are always bright, and the pupils remain movable; the subsequent sleep is refreshing; the consciousness returns fully restored—all of which is more or less different in true epilepsy.

The following table gives, in a brief manner, the differential diagnosis between epilepsy and hystero-epilepsy. (A lecture of Charcot's, as quoted by Hare.)

TRUE EPILEPSY.	HYSTERO-EPILEPSY.
1. Aura short.	1. Aura extremely prolonged.
2. Cry is violent and at onset.	2. Cry is more moderate and prolonged and during the course.
3. Spasms first tonic, then clonic, then followed by stertor.	3. Ataxic contractions, extension of limbs, turning of head, clonic movements, slight stertor.
4. Sometimes, after fit, delirium or violent impulse or mania.	4. Bizarre contractions, no delirium; may be hallucinations.
5. Mental power is lost.	5. Mental power preserved.
6. No emotional attitudes.	6. Emotional attitudes.
7. Onset always sudden.	7. Onset often gradual.
8. Duration a few minutes.	8. Duration more than ten minutes, often much longer.
9. Talking never.	9. Talking frequent.
10. Micturition and defecation frequent.	10. Micturition and defecation never.
11. Biting tongue.	11. Biting lips, hands, or other people and things.

Epilepsy may also be confounded with comatose states and with other convulsive attacks, such as cerebral congestion, uræmia, apoplexy, etc.; the following table (quoted from Ranney) gives the differential diagnosis between epilepsy and these various affections:

Prognosis.—As regards life, the prognosis is favorable. Death rarely ever occurs during the convulsion, except from an accident, such as a fall, drowning by falling into a ditch, tub of water, etc., not being able to assist themselves; or, in those cases subject to vomiting after the attack, the vomited particles may cause strangulation by getting into the larynx. Another cause of death, especially in those cases subject to nocturnal fits, is suffocation from turning over during the attack and burying the face in the pillow. As regards a cure, the prognosis will depend to a great measure upon the time of life at which the disease made its appearance, the duration of the disease, and the number and frequency of the attacks. The frequency of the fits and their early development are the two most important factors to be taken into consideration when forming the prognosis as to the degree of mental impairment likely to result. The earlier the age at which epilepsy springs up, the

	EPILEPSY.	CEREBRAL CONGESTION.	APOPLEXY.	URÆMIA.	HYSTERIA.	MALINGERERS.	SYNCOPE.	ORGANIC LESIONS OF BRAIN.
1. Sensibility.	Abolished during fit.	Usually unaffected.	*Anæsthesia*, as a rule, in one side.	May be unimpaired.	May be diminished.	Normal (in conjunctiva).	Not abolished.	Affected if sensory area is involved.
2. Pupils.	Dilated during fit.	Contracted.	Often *irregular*.	Variable.	Normal.	Normal.	Frequently dilated.	May be irregular.
3. Tongue.	Scarred or ragged.	Not bitten.	Not bitten, as as a rule.	Not bitten, as a rule.	Not scarred or bitten.	Not scarred or bitten severely.	Not bitten.	Not bitten.
4. Consciousness.	Lost during fit.	Retained, as a rule.	*Prolonged coma.*	*Coma.* Very prolonged and deep.	Rarely lost entirely.	Can be made to exhibit it.	Incomplete coma.	May be unaffected.
5. Urine.	Normal.	Excess of phosphates. Oxalate of lime.	Normal.	*Albumin and casts.*	Excessive in quantity; pale in color.	Normal.	Normal.	Normal, as a rule.
6. History.	*Inherited, predisposition*, previous attacks of a similar kind.	Insomnia. Cranial pain. Vertigo.	Usually negative.	*Ascites.* *Nausea.* *Vomiting.* *Waxy pallor.* *Urinous odor.* *Headache.*	Hysterical symptoms precede or accompany the attack.	Suspicious, overdo the symptoms.	Heart lesions, anæmia, chlorosis, etc.	Pain. Tremor. Paralysis. Imbecility. Affection of speech. Affection of special senses.
7. Stupor.	Follows fit; and is short.	May occur.	It is prolonged. Stertorous breathing.	Liable to be prolonged.	Does not follow fit. No stertor.	Assumed.	Does not follow attack.	May be developed.
8. Paralysis.	Absent.	Absent.	Present; usually of motion and deviation on one side.	Absent.	May exist.	Absent.	Absent.	May occur.
9. Recovery.	Moderately rapid.	Modified by the type which exists.	Slow, if not fatal.	Slow, if not fatal.	May be slow or rapid.	Rapid.	Rapid.	Slow, if not fatal.
10. Pulse.	Small or absent during tonic stage.	Irritable; easily excited.	Slow and full.	Variable.	Small, feeble, rapid.	Normal.	Rapid.	Modified by seat of lesion.
11. Temperature.	Usually elevated during attack; especially true of status epilepticus.	Usually normal.	Lowered.	Low; may reach 92° F.	Normal.	Normal.	Normal or lowered.	May be raised or lowered.
12. Asphyxia.	Very marked in clonic stage.	Absent.	May exist.	May exist.	Only partial or absent.	Absent.	Absent.	May exist.

deeper it undermines the organic and moral constitution, and the more disastrous are its results. It is unfavorable when it begins in the early age of childhood and is prolonged beyond the age of puberty; fits beginning in early childhood may result in imbecility or idiocy.* It is better if the disease begins after twenty than before. It is better in cases in which it has existed for less than a year; less favorable where it is of several years' duration. The prognosis improves if during the course of the disease the fits appear more infrequently, and are shorter and lighter. The so called idiopathic epilepsy is more hopeless than organic epilepsy. Epilepsy due to syphilis is the most favorable of all the varieties; in the majority of cases it can be cured, and in nearly all cases improved. It is less favorable in post-hemiplegic epilepsy than in idiopathic cases. It is more favorable when there is an inherited tendency than where there is not. (Herpin.) It is better in cases preceded by an aura than where they are not. It is better in grand mal than in petit mal. A great many of the cases of petit mal eventually pass into that of the ordinary fully developed attack of grand mal. Nearly all forms of epilepsy tend to weak-mindedness; every grade of mental impairment may be met with, even to actual imbecility. It tends in some degree to impair the mental faculties, to dim the reasoning powers, to blunt or pervert the feelings, emotions, and sensibilities, to lessen the self-control, and to change the character. But if the attacks are few and far between, only a few in a lifetime, there may be no appreciable change in their condition, if, in truth, there be any at all. The tendency to imbecility or weak-mindedness is increased if there is a strong neurotic inheritance, as the patient in that case has a strong predisposing cause, and an equally strong exciting one. In cases in which epileptic mania has developed, the prognosis is unfavorable, for it generally goes from bad to worse, and eventually terminates in dementia.

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* Epilepsy occurring before seven years of age is almost certain to leave the patient weak-minded. (Savage.)

Nevertheless, many cases in which there has been considerable mental impairment have eventually made good recoveries. In many cases, although the disease cannot be cured, the life of the patient may be made more pleasant and useful by lessening of the frequency and violence of the attacks. In other cases, however, no improvement can be obtained by any means whatsoever.

Treatment.—The treatment of epilepsy resolves itself chiefly into surgical measures and therapeutical means. Electricity, especially the static, will prove beneficial in many cases. If the disease is due to a tumor or a depressed bone, this must be removed—that is, if the fits are local and partial, and there is reason to believe that the mechanical irritant can be completely removed, an operation is justifiable; but if the convulsions spread, not only through the side in which they began, but also to the other side, the probability of benefit is much diminished; if due to reflex irritation, such as phimosis, ovarian irritation, etc., the peripheral source of trouble must be sought out and relieved, even though the improvement obtained should be only temporary, as this may pave the way for medical and electrical treatment. Marked errors of ocular refraction should be remedied, but the removal of the insufficiency of ocular muscles is rarely, if ever, called for. In many cases the removal of the cause will cure the case; in other cases, however, the removal of the cause will prove of little or no benefit, for the habit, once becoming established, is hard to overcome; in other cases the removal of the cause will cause the attacks to disappear for the time being, but later they will return.

No case should be pronounced "cured" when, after a short course of treatment (medical, electrical, or surgical) the attacks cease, for epilepsy will do well for a time upon any change of treatment, whether that treatment be medical, electrical, or surgical; whether it consists in cutting off the prepuce, removing the nares, or cutting the eye-muscles as advocated by a late writer, for all the ills that flesh is heir to.

Trephining, an old remedy, has been lately brought into fresh prominence, but there is no doubt that the advocates of trephining for epilepsy have entertained exaggerated views with regard to the influence of injuries to the skull on the production of disease. Among three thousand cases of epilepsy, Althaus did not find a single case which presented fracture of the cranial bones with depression of the skull; therefore we should not advise the performance of trephining, unless the epilepsy evidently followed an injury to the skull that was accompanied by distinct fracture of the bones, with depression.

Epilepsy is very successfully treated with the "static." By its physiological and tonic action upon the brain and nerve-centers, the current quiets the patient and builds up the physical condition. The attacks will gradually become less severe, and a longer period will intervene between them. The patient will improve physically and mentally. Caldwell advises negative insulation for five minutes, positive direct head and spine breeze for five minutes, concluding frequently with a very mild direct positive spark on the lower extremities. This treatment to be repeated every day, or two or three times a week. as the indications of the case call for.

During the attack very little can be done in the way of treatment. The patient should be placed in a horizontal position, and in those cases subject to biting the tongue a cork or a small piece of India rubber placed between the teeth will prevent this accident. After the fit, place the patient on a sofa or bed, darken the room, and let him sleep it off; thus aiding Nature in her efforts to get over the effect. Sleep is Nature's mode of restoring the disturbed cerebral circulation and recuperating exhausted organs. As a rule, it is difficult to at once select the remedy in epilepsy, for the reason that epileptic attacks resemble each other so closely. To cure this disease, you will have to take into consideration the symptoms of each case, and prescribe accordingly. This will often be a difficult task, for the symptoms of epilepsy present great similarity in all cases, and differ more in degree than in kind. No matter how desperate the case may seem, even though there be considerable mental impairment, do not give the case up to a life of hopeless despair, but with your indicated remedies treat it as you would any other diseased condition, and you will many times be surprised at the marvelous results that will reward you for your labors.

Absinthium.—True epilepsy; the person becomes pale, loses consciousness, falls, sometimes utters cries, and the face is convulsed; this is followed by tonic convulsions, with tetanic rigidity of limbs and body; face becomes violet and cyanotic, breathing rapid, irregular, stertorous; froth from mouth; tongue is bitten, terrible hallucinations, and at last he passes into a comatose state, which continues for various periods. After consciousness is recovered the individual seems dazed, stupid, and he remembers nothing of what passed.

Amyl nitrite.—A few drops of the drug, placed on a handkerchief, and inhaled during the epileptic aura, will in most cases check the attack. It is indicated in those attacks preceded by flushing of the face, head, and neck, with heat and perspiration of the same, accompanied with cold hands and feet; also, violent palpitation of the heart; this symptom is quickly followed by loss of consciousness. After the attack there is mental confusion and a dream-like state, the patient being haunted by an indescribable dread and sensation of an oncoming fit. The attacks succeed each other rapidly.

Argent nit.—The pupils permanently dilated for some hours or days before the fit; epileptic convulsions coming on at night; after the attack, the patient is very restless, and has trembling of the hands, or the attack is followed by delirious rage, tries to strike those about him. Especially indicated in epilepsy caused by fright, or in that which comes on during menstruation; also in cases of long standing, where there is great melancholia and weakness of memory; cannot fix the mind upon anything; general appearance imbecile; talks very childishly; general impairment of the mental faculties.

Arsenicum.—Epileptic convulsions, preceded by a sensation of warm air steaming up the spine into the head; before the attack he has spells of vertigo and intense aching in the occiput; the patient falls down unconscious, and then writhes in convulsions; convulsions followed by stupor, which, however, is not complete, but is broken by restlessness; burning in the spine, frequent cramps in the calves.

Artemisia vulgaris.—Epilepsy occurring after fright or some exciting mental emotion, and when attacks follow one another rapidly, that is to say, when there are several convulsions coming close together, and then a long interval of rest, followed by deep sleep and later by offensive perspiration like garlic; epileptic convulsions mostly in the mornings; moroseness, excitability, and irritability the day before the attack; suppressed, irregular, or deficient menstruation, with epileptic convulsions.

Belladonna.—Recent cases of epilepsy, with active cerebral congestion; previous to the attack, face flushed scarlet, headache, throbbing in the temples, eyes glistening, with dilated pupils, intolerance of light, accompanied by coldness of hands and feet; twitching and jerking during sleep. The fits are preceded by auræ, which begin in the extremities, pass up to the throat and head; spasms in the larynx and fauces; clutching of the throat during the fit; convulsions with stiffness of the entire body; thumbs clenched in the palms; foaming at the mouth; involuntary micturition and defecation; oppression of the chest and anxious breathing; after the attack, disposition taciturn and stubborn.

Bufo.—Epilepsy following onanism or over-sexual excitement. The aura that begins the fit starts from the genital organs or from the solar plexus; the attacks are often preceded by singular irritability of mind, during which the patient talks incoherently, and is vexed because his gibberish is not understood; before spasm angry for several days; easily laughs and cries; attacks come on in sleep; are followed by severe pain and pressure in top of head: if awake, may have a sensation preceding the attack as of numbness of the brain, or a feeling of general numbness, immediately followed by a spasm; head at first drawn to one side, either right or left, then backward before an attack; first, muscles of the face commence to twitch, extending thence over the whole body. The convulsions are usually followed by profound sleep. The fits occur mostly at the change of the moon, at the times of the menses, or during sleep. It is indicated in epileptic imbecility with loss of all decency; the patient is vehement and excitable.

Calcarea carb.—Scrofulous or delicate and poorly nourished individuals. The aura which precedes the attack, in some cases, begins in the solar plexus, passes upward, and the patient is at once thrown into convulsions. In other cases the aura begins in the arm, and feels as if a mouse were running up the arm. In still other cases there are sudden attacks of vertigo; loss of consciousness without convulsions; after the fit apprehension of never getting well again; mental dullness or even derangement. Nocturnal epilepsy. Epilepsy following fright, suppression of some chronic eruption, or from excess in venery. Cal. carb. is one of our chief remedies in the treatment of epilepsy. Its value lies, however, more in its ability to correct the peculiar dyscrasia which underlies the disease than from any power which it has over any particular form of convulsions.

Cannabis indica.—Headache, especially through the temples, with vertigo; gilmmering before the eyes; noises in the ears; head feels as though it would burst. Especially indicated in those attacks preceded by a stage of mental excitement; great exaltation of spirits and of bodily and mental vigor; an ecstatic exaltation of all the powers of mind and body. Especially indicated in hystero-epilepsy.

Causticum.—Recent and light cases. Especially indicated in petit mal. When walking in the open air the patient falls, but soon recovers; during the unconscious stage the patient passes urine; convulsions especially on the right side, with drawing of the head and eyes toward the same; the attack ceases after the patient drinks water. Epilepsy due to suppressed exanthems or ulcers; also indicated in epilepsy when it is connected with menstrual irregularities and when it occurs at the age of puberty. Epilepsy in which the attacks occur at the time of the new moon.*

Cicuta vir.—At first the patient is rigid, with fixed, staring eyes, pupils dilated, bluish face, frothing at the mouth, great oppression of breathing, complete loss of consciousness; then follows a series of tremors or shocks passing from head to foot, followed by jerks and violent distortions of the limbs. The fit is followed by utter prostration. (Typical attack of grand mal.)

Cuprum.—Nocturnal epilepsy, or when the fit returns at regular intervals, as, for instance, the menstrual period; also, in apparently hopeless cases of long standing. Nausea and vomiting before the attack; extremities cold; trembling. The attack ushered in by the so called " epileptic cry "; convulsions; loss of consciousness; pale or livid face and lips; eyeballs rotated; frothing at the mouth; grinding of the teeth; involuntary discharge of urine; *violent convulsions* which follow each other in rapid succession; the convulsion followed by deep sleep. After the attack the patient complains of headache, feels tired and prostrated; feels as though he had been beaten.

Cypripedium.—Epilepsy from reflex nervous irritation; when the result of some gastric or intestinal irritation; the reflex excitability of the cerebro-spinal centers is arroused, the brain becomes irritated, and convulsions impend.

Glonoine.—Attacks immediately preceded by flushed face, headache, ringing in the ears, and other evidences of cerebral hyperæmia. Epileptic fits accumulate and return daily. Especially useful in minor attacks, and will often prevent the occurrence of the post-epileptic hysterical convulsion.

Hyoscyamus.—Especially indicated in children; twitching of the muscles during sleep; cry out and tremble, and awaken frightened; the child awakens hungry; the symptoms aggravated by eating; excitement, desire to speak, inclination to become angry to furiousness; hallucinations; face pale or of a deep red color—almost purple; clonic convulsions; sudden fall, with a cry and loss of consciousness; frothing of the mouth and biting of the tongue; attacks of but short duration, and followed by profound sleep.

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* In explanation of this phenomenon, Farrington says, that the moon has nothing to do with these epileptic attacks. It is only the laws which govern the relation of the planets, which regulates the tides and have to do with the periodicity of nature generally that also apply to the moon, and to the disturbances within the human body: so it is that some symptoms are worse at new moon, others at full moon; some at the rise and others at the fall of the tide. It does not, therefore, follow because the patient is worse every time at new moon, that the moon causes the aggravation.

Hydrocyanic acid.—Hydrocyanic acid is one of our main stays in epilepsy. The specific action of this drug is upon the cerebro-spinal nervous system, and particularly upon the medulla and upper portions of the spinal cord. It produces convulsions similar to those of fully developed epileptic attacks; great irritability, vertigo, hebetude, and a sensation of drunkenness, followed by sudden and complete loss of consciousness; the body is stiffened and thrown back; breathing comes in paroxysms; the jaws are clenched, teeth firmly set, unable to swallow; a bloody foam issues from the mouth, the face is swollen, the limbs are rigidly contracted and the hands clenched; the eyes are rotated toward the right and upward, and appear to start from their sockets. These tonic spasms are quickly followed by clonic spasms; there are frightful distortions of the face and limbs; great drowsiness and prostration after the fit. It is especially indicated in recent cases. The lower attenuations, 1x or 2x, seemingly work better than the higher. In many instances it will not at first check the convulsions, but will render them much milder and shorten their length, and eventually make a complete cure.

Ignatia.—Recent cases, where the paroxysms originate from fright; face pale, cold; fixed, staring look; jerking of the body; partial spasms of the extremities, one limb or only certain muscles at a time; lassitude after the fit. Emotional epilepsy.

Indigo.—Epilepsy originating from reflex irritation or from fright; flushes of heat from abdomen to head, with sensations as if the head were tightly bandaged around the forehead;

patient tired of life, feels very gloomy. This remedy never does any good unless the patient is low spirited or sad or timid; where he is vehement or excitable, nux or bufo is indicated.

Kali bromatum or bromide of potash.—This drug acts chiefly upon the nervous system, and acts, too, in two opposite directions. Primarily it decreases reflex action; secondarily, it depresses the mind. This property of the drug to modify a reflex action has led to its extravagant use in the treatment of epilepsy by the allopaths (45 to 200 grains per day being given); it is their "sheet anchor," their great "anti-epileptic" remedy. Farrington (than whom we have no better authority on this subject) says that he does not believe that it ever cured epilepsy; that in almost all cases in which it has been given in such large doses, it has not *cured*, but simply *suppressed* the disease, and thus has produced a worse condition than the one primarily existing—namely, *imbecility*. It is indicated in attacks followed by acute mania, where there is sleeplessness and strong imagination; in night terrors of children; but its great sphere of action is in those cases of epilepsy of long standing, where there is failure of memory. The patient cannot remember words particularly, and there is a distressing melancholy; everything looks dark and gloomy; he has a dull, stupid expression. The whole mind and body are given up to lassitude, but nowhere are there convulsions.

Kali iodatum.—Especially indicated in syphilitic cases; headache, vertigo, and thickness of speech preceding the attack, followed by coma and convulsions. During the intervals the patient is irritable and easily angered.

Lachesis.—The attack preceded by headache, vertigo, palpitation of heart; convulsions ushered in by epileptic cry; falls as if struck with a blow, unconscious; foams at the mouth; sudden and forcible protrusion of the tongue; trismus and spasm of the larynx; blueness from asphyxia; convulsions chiefly left sided. This remedy is of special value in chronic cases, where they complain of great physical and mental exhaustion, especially in the morning and *after sleep;* also in cases addicted to onanism and excessive sexual indulgence.

Nux vom.—The aura preceding the attack begins in the solar plexus; irritability, anguish, painfully sensitive to sounds; convulsive twitching in the limbs and trembling of the whole body; tonic convulsions; loss of consciousness; involuntary defecation and urination; attacks prone to appear in the morning. Especially indicated by hystero-epilepsy where pressure on the solar plexus renews the attack and in spinal epilepsy.

Œnanthe.—Rapid convulsive twitchings of the muscles of the face; face ghastly, livid, and turgid, tongue protruding; bloody froth issuing from the mouth; violent convulsions followed by unconsciousness; patient utters loud cries and falls to the floor, then loss of consciousness, clonic spasm of limbs, frothing at mouth, rolling of eyes, clenched thumbs, alternate redness and paleness of face, and involuntary escape of stool and urine; no aura; attacks often three or four times a week; sleep of several hours' duration, followed by heaviness in the head, lassitude, and prostration; memory somewhat impaired.

Opium.—Nocturnal epilepsy; profound stupor, with stertorous breathing; respirations deep and unequal; patient cannot be aroused from the stupor; pupils widely dilated, face bloated, red, and cyanotic; suffocative paroxysms during convulsive state.

Platina.—Especially indicated in boys for the ill effects of pre-pubic masturbation. It is called for by the melancholy and the sheepish look that those individuals have. The youth has hollow eyes and yellow skin. During the attack the face is pale and sunken; in fact, it may be so at all times. Consciousness is not often lost. The jaws are locked and the limbs are usually drawn up and spread apart.

Plumbum.—Clinically, plumbum has won its brightest laurels in chronic cases based upon organic lesions. Its characteristic indications are vertigo, severe headache, either occipital or frontal, insomnia, noises in the ears, disordered vision, diplopia, amaurosis, heaviness, numbness or a pricking sensation in the leg before the attack (almost paralytic heaviness); a feeling as if a ball ascended from the epigastrium along the thorax to the throat, where it causes a feeling of suffocation; violent and severe constriction of the throat. After the attack, paralysis and prolonged snoring sleep; consciousness returns only slowly and the symptoms of paralysis remain for a longer or shorter period. Especially indicated in chronic cases of epilepsy.

Silica.—Nocturnal epilepsy; especially about the time of the new moon. The patients are worse from any overstrain of the mind or emotion. The patients are poorly nourished from their inability to properly assimilate food; inclined to perspire about the head and feet; take cold easily; are restless and sleepless at night, and present the general constitutional symptoms of this drug. The attacks are preceded by a well-marked aura, which starts from the solar plexus and passes upward to the head, and when it reaches there, the patient loses consciousness; coldness of the left side of the body; shaking and twisting of the left arm; screaming, groaning, and foaming at the mouth; followed by warm perspiration, slumber, and paralysis of the right side. It is indicated in chronic cases due to malnutrition, not in consequence of poor food, but deficient assimilation; scrofulous individuals, constitution feeble, skin thin, delicate; face pale. Especially useful in the case of children with large open fontanels and subject to copious perspiration of the head, and great tenderness of the surface of the body. Silica, from its deap seated action, is more often curative in chronic than recent cases.

Sulphur.—Excessive venery, or wherever some dyscrasia lurks in the system, or its outward symptoms were suppressed. The aura consists of a sensation as of a mouse running up the back and arms, followed by convulsions; after convulsions, soporous sleep and great exhaustion. Especially useful in chronic epilepsy.

Zincum.—Symptoms felt mostly during rest; twitching in various muscles; the whole body jerks during sleep; between attacks cerebral depression, headache, melancholy, loss of memory; forgetful of what has been done through the day; symptoms all aggravated after dinner; in doors; better in open air; while eating.

Chorea.

(*St. Vitus' Dance, Sydenham's Chorea Proper.*)

Chorea is derived from the Greek word *χορεία*, signifying "a dance."

Chorea is a functional nervous disorder characterized by irregular, spasmodic movements, quickly beginning and quickly ending fibrillary jerks or a fibrillary wavy movement, by incoordination of voluntary movements, and often by muscular and mental weakness. This is the common type of chorea, and is the disease ordinarily meant when the term "chorea" is used.

Ætiology.—AGE.—Chorea is essentially a disease of the later period of childhood, the larger majority of cases (four-fifths) occurring between the ages of five and fifteen years. It is very rare under five. It is very infrequent during adult life, and becomes extremely rare in old age.

SEX.—It affects girls more than boys—nearly, but not quite, three times as frequently.

HEREDITY.—There is little evidence of direct heredity in chorea proper, although it is unquestionably an evidence of a neurotic ancestry; that is, a choreic subject may have a history of hysteria, epilepsy, neurasthenia, or insanity among different branches of his family, but not necessarily a history of chorea.

CLIMATE.—Climate has little influence as a causation of chorea. It occurs as frequently in warm as in temperate countries. The season of the year, however, seems to have an influence on the affection. Weir Mitchell and Sinkler have shown that the greater number of cases of chorea occurred in those months in which there are the largest number of cloudy days, the greatest amount of snow-fall, and the greatest amount of barometric disturbance, while high or low barometers seem to have no effect upon the disease. Morris Lewis of Philadelphia found that most of the cases occurred during the spring months.

RACE.—Chorea is a very infrequent malady in the negro race, especially in those of pure blood. (Mitchell.) In this country it is more common in children of German, Hebrew, and Portuguese race.

RHEUMATISM.—Rheumatism is one of the most common causes of chorea. M. See states that one-half the entire number of cases of chorea are caused by the rheumatic poisoning. Among 128 children affected with chorea, he found 64 cases of acute articular rheumatism. Other authorities claim that this proportion is too high; that not over one-fourth or one-third of the cases of chorea are caused by this factor; that the diagnosis of rheumatism as an ætiological factor in chorea is frequently made on insufficient data. As a rule, chorea, when connected with rheumatism, develops in the later stages of this affection, or at a varying interval after recovery. In rare instances, however, the chorea precedes the attack of rheumatism in point of time.

As a rule, the rheumatism is neither violent nor obstinate. The more acute, severe, and extensive the articular affection, and the more it is complicated, either in the beginning or at a later period, with cardiac affections, the slighter will be the choreic manifestations.

Organic heart disease seems also to act as an ætiological factor in the production of chorea. It may be developed during the course of chorea or may precede it. Fright frequently acts as an exciting causative factor in the production of chorea; as a rule, the development of the chorea follows this exciting cause after a lapse of from six to forty-eight hours; rarely exceeding a week. Regarding the combination of the three conditions, rheumatism, organic heart disease, and fright, Gowers says he has found that cardiac disease was present (either before or during the chorea) in three-fourths of the cases in which there was a history of rheumatic fever, while in those without such history there was heart disease in only a third. Fright was the apparent cause of the chorea in a rather larger proportion of the patients who had had rheumatic fever, or preceding heart disease, than of those who had not. The other emotions, such as joy, grief, etc., rarely, if ever, cause this affection. Imitation has often been observed as the cause of chorea. The disposition to imitate has generally been assigned as the cause of such manifestations becoming epidemic among children. Other causes are trauma, reflex irritation arising from the genitals, the intestines, dentition, eye-strain, etc.; sometimes it follows infectious fevers, especially measles, scarlatina, and whooping cough. Pregnancy may act as a cause, especially in primiparæ under twenty-five. Anæmia and malnutrition underlie most cases.

Symptoms.—Preceding the onset of the disease, patients may be subject to headache, slight loss of memory, and inability to apply themselves to their studies as well as formerly; disinclination toward mental or bodily pursuits; there is also a change in disposition—children who were previously of an obedient and mild disposition become irritable, obstinate, and perverse.

As the disease develops, the choreic movements manifest themselves in the fingers, hands, arms, and the facial muscles by slight twitchings. At the same time the child begins to exhibit a certain awkwardness of movement in the extremities, especially the upper extremities; thus objects such as dishes, etc., which are being carried, are suddenly dropped, this often being attributed to carelessness on the part of the child, and for which it is often unjustly punished. Later on it is only with great exertion that they are able to eat, write, sew, or perform upon musical instruments. As the disease progresses, it becomes impossible to keep the hands still; the fingers and hands are rapidly and aimlessly opened and shut; the arms rapidly flexed and straightened, or rotated—the whole extremity being in a constant state of agitation.

The muscular symptoms gradually spread in intensity and extent. The lower limbs become involved, and it becomes difficult for the child to stand still or to walk. Before long the muscles of the neck and face participate. When the neck muscles (especially the sterno-cleido-mastoids) are involved, it causes the head to be thrown forward or backward, or to be jerked from side to side. When the facial muscles are involved, it causes irregular twitchings of the eyelids and the angles of the mouth, thus causing a continued series of grimaces and a grotesque appearance; at times the mouth is thrown widely open and the tongue is rapidly protruded, to be as quickly withdrawn.

The muscles of respiration and phonation may become involved; inspiration is frequently interrupted before the act is complete by a sudden expiratory movement; the speech of the patient is often interrupted by a sudden, deep inspiration, which cuts off the last syllable of a word. Words are uttered quickly; sometimes the words are jerked out in separated parts; actual stammering is rare.

When the disease is at its height (usually at the third or the beginning of the fourth week), all the voluntary muscles in the body may be affected by the choreic movements. The arms, legs, face, and head are no longer under the control of the will, and are in almost constant action; voluntary acts are performed with great difficulty, or become impossible. Every attempt to perform a voluntary movement excites still more the disorderly action. If the attempt is to drink a glass of water, he experiences great difficulty in grasping the glass and is unable to carry it directly to his mouth; is apt to spill part of its contents upon himself; he can carry a morsel of food to his mouth only after repeated attempts; while eating, will jerk a fork away as it is about to enter the mouth; or he may possibly strike the ear or nose with the fork. In other cases the patient is unable to feed, bathe, or dress himself, and sometimes even walking becomes impossible. Any unusual excitement of the mind or body is apt to intensify the muscular twitchings. Such patients are usually very sensitive in regard to their affection, and the consciousness of the fact that they are objects of attention, adverse criticism, and remarks has a tendency to aggravate their symptoms. Any effort at precision or deliberation seems only to make matters worse.

In severe forms of chorea, the movements are so violent at times that the patient must be strapped in bed, or else someone must be placed on either side of it to prevent his being thrown out. The movements may only involve one-half of the body, and then constitute a variety of the affection known as "*hemichorea*." There is usually slight, but never complete loss of muscular power in the limbs affected.

In severe cases attacks of mental excitement and even delirium come on for several successive nights, and this may be so marked a feature as to form what is called *chorea insaniens*, or *maniacal chorea*. (Dana.)

The mental state in slight cases of chorea may be normal, but in severe cases there is usually more or less impairment. It may consist of an excessive irritability, a dullness of apprehension, loss of memory, proneness to laughter over trivial things, attacks of weeping without apparent cause, or strange hallucinations and delusions. In rare instances idiocy or mania may develop during the course of chorea. Choreic subjects are apt to be pale and anæmic, and it is not uncommon, therefore, to detect an anæmic murmur over the heart and the jugulars. During sleep the convulsive movements usually cease entirely. There are cases, however, in which the movements continue, though diminished in severity, during slumber. It is a curious and interesting fact that patients do not complain much of fatigue, although the movements are quite violent and continuous.

Sensibility is, as a rule, unaffected. It is a painless disease, except from complication of some painful disorder. The pulse and temperature are, as a rule, normal. The appetite is poor and capricious, the tongue coated, and the bowels are usually constipated. The sphincter muscles, being partly voluntary and partly involuntary, are sometimes embarrassed in the voluntary performance of their functions; thus causing retention or incontinence of urine and difficult or involuntary stool.

Certain cases of chorea have a tendency to develop. This developmental tendency should always be borne in mind, because much blame may be attached to a physician if he has not forewarned the parents that this is one of the possibilities; and, moreover, a case which seems harmless at the beginning may become transformed into one of very serious import.

Paralytic chorea is a form where one arm becomes rather suddenly weak and powerless. A few twitching movements are observed. This form occurs only in children and runs the same course as the spasmodic type. (Dana.)

" Choremania " was a term given to the epidemic impulse to dance which spread so extensively in middle Europe on several occasions in connection with religious movements, and which, according to Yandell, has occurred on the occasion of revival movements in Kentucky early in this century. During the Middle Ages whole communities were affected with the disease. In some communities the number affected ranged from five hundred to one thousand; business being entirely suspended, and all classes taking part in the revels. Men and women would form circles hand in hand and dance for hours together, until they swooned or a state of exhaustion ensued, very much as is the custom in the " ghost dance " or the " Messiah dance " of our North American Indians.

In those forms of chorea met with more especially in school-children, due to imitation, the muscular contractions are usually more sudden and shock-like than in true chorea. These types of chorea are usually transient, and quickly vanish when the patient is withdrawn from the influence of example. Stammering is a form of chorea, and consists in the momentary inability to pronounce a sound or to connect it with other sounds, and is owing to deficiency in the co-operative power of the larynx with the movements of the mouth. In Switzerland there is a proverb that stammering in the parent announces cretinism in the child.

Course and Duration of Chorea.—Chorea is a disease that is self-limited, running its course in from six to ten weeks; severe cases, however, may continue four or five months, or even a year or so. This period, however, can be materially shortened by appropriate treatment. Chorea is a disease prone to recur. The interval between the termination of the first and commencement of the second attack varies from a few weeks to two or three years. It is rarely less, however, than two months, or more than three years. The average interval is about one year. (Gowers.) After three years, relapses practically cease. The more severe the disease the longer will be its probable duration. Subsequent seizures are usually less severe and terminate sooner than the first. Relapses occur in about one-third of the cases, and rather oftener in girls. The number of relapses may vary from one to six or eight, or even more, but rarely more than once or twice. The tendency of chorea is to increase to a certain point, and then to gradually diminish. It is common to find that patients who have suffered from chorea in early youth, in later years become subject to hysteria or other neuroses.

Pathological Anatomy and Pathology.—Very little aid can be derived from pathological anatomy in determining the cause or the location of the lesion in chorea, if any exists. The seat of the lesions in chorea undoubtedly is the gray matter of the cortex; yet there are no lesions of the brain or the spinal cord that are characteristic of chorea, for similar lesions are found in the brains of individuals who have never suffered from chorea. In many cases certain changes have been found in the brain-structures, such as macroscopic and microscopic spots of softening, congestions, extravasations, embolism, peri-arterial extravasations and erosions, minute hemorrhages, dilatation and thickening of the arterioles, degenerative changes in nerve-cells, varicosities of nerve-fibers, old spots of sclerosis, hyaline bodies, and chronic leptomeningitis of the cerebrum. Such of the above changes as are not accidental concomitants of chorea are probably the result of the excessive and perverted functional activity of the nerve-elements, as all functional disorder is attended with nutritional change, and consequently attended by vascular changes in the part affected.

That the primary seat of the disease is in the brain, and not in the spinal cord, is demonstrated by the symptoms of irritation, which are observed on the part of various motor cranial nerves; by the disturbance of ideas and of speech; by the development of psychical affections; by the fact that the movements cease during sleep; and from the frequency with which chorea is unilateral, or commences unilaterally. It is also shown by the appearance of chorea in apoplexy, softening and tumors of the brain, and by its aggravation after mental excitement.

The mechanism by which the peculiar phenomena of chorea are produced is unknown. Morris Lewis of Philadelphia ("Annual of Universal Medical Science," 1893), who studied the seasonal relations of chorea and rheumatism for a period of fifteen years, says that chorea and rheumatism are periodical; the least severe attacks in chorea occurring in October and November, and the most severe in March and April.

There can be no doubt now entertained as to the close connection between chorea and rheumatism. The relations existing between chorea and rheumatism and diseases of the heart have been studied carefully by Walton and Vickery, who arrive at the following conclusions: (1) That neither rheumatism nor heart disease is essential to chorea. (2) That the preponderance of evidence points toward the conclusion not only that rheumatism and organic heart disease conjointly appear more frequently in chronic subjects than can be accounted for by coincidence, but that the same is true of each of these affections separately. It follows, therefore, that rheumatism predisposes to chorea, and organic heart disease has the same tendency. (3) That fatal cases are generally associated with organic heart disease, and probably with organic disease of the central nervous system, notably *cerebral embolism*. (4) That the pathological connections between rheumatism and chorea, excepting in the cases where emboli are produced by accompanying endocarditis, is still obscure; probably no one theory is applicable to all cases.

An attempt has been made of late years to show that chorea is due to some infection. Richter has found cocci in the blood in one case; Donkin, rod-like bodies in another; Berkeley believed that the pathological finding in another case was similar to those of diphtheria; but proof of this is yet entirely lacking. (Gray.)

Another hypothesis is that the common cause of endocarditis and chorea is a blood-state allied to, but not identical with, that which causes acute rheumatism. (Gowers.)

According to the precise nature of the blood-change, chorea or acute rheumatism, or both, with or without endocarditis, may be produced. The facts of these diseases suggest a toxic change of a chemical character rather than an organized virus. Of the mechanism by which the assumed blood-change causes chorea we are still ignorant; but it is probable that a special influence is exerted on the motor elements of the cortex, deranging their function and producing a disturbance of their nutrition, which, once excited, runs a certain course, varying in severity and duration, but tending eventually to subside. We must not, however, regard the blood-change as more than one element in the causation of chorea. The fact must not be lost sight of that cases are brought on almost immediately from the effects of fright, and that such cases could not possibly be due otherwise than to functional disturbances acting as an excitant of the disease.

Diagnosis.—The diagnosis of chorea is, as a rule, not difficult; the peculiar and characteristic twitching or the fibrillary, wavy movement are not liable to be confounded with any other affection. About the only affection with which it is liable to be confounded is convulsive tic, or, as it is sometimes termed, "the jumpers of Maine."

Prognosis.—The prognosis of chorea is usually favorable; the larger proportion of cases recover completely; death rarely occurs except from some fatal complication, such as endocarditis, pericarditis, meningitis, encephalitis, etc. Death may result, however, in exceptional instances, from exhaustion from the violence of the movement or from loss of sleep. The mental faculties are always restored, the only exception being when there has been severe mania; in those cases dementia may supervene.

Treatment.—One of the most important factors in the treatment of chorea is rest. Exercise, when permitted, should be of a mild character; all violent exercise should be prohibited. All causes that produce mental excitement should be guarded against. In the majority of cases the child should be taken from school, and in very severe cases better results will be obtained by placing the child in bed for a longer or shorter duration. Even in moderate cases the good effect of a few days' absolute rest is most conspicuous, and is often desirable at the commencement of the treatment.

As has been said, the greater majority of choreic patients are anæmic and debilitated; some have been deprived by poverty of a sufficiency of good, wholesome food; others have been overworked either bodily or mentally. These causes are all capable of being removed, and are of such importance in the treatment that they should never be overlooked or neglected. In chorea resulting from reflex causes the first line of treatment is to remove the exciting cause.

Electrical Treatment.—In electricity we have a most valuable agent in the treatment of chorea. It cures, almost without exception, even cases which have resisted all medication.

Good results have been obtained from the use of the static, the galvanic, and the faradic currents; but, personally, I have obtained the most brilliant results from the employment of static electricity; in fact, its effects are often truly surprising. Its method of application will vary in different cases. In those cases that are debilitated and anæmic (and the greater majority of cases of chorea are in these conditions) the patient is to be insulated with the positive pole for ten minutes, and then the negative direct breeze is to be applied upon the head and down the spine for five minutes, concluding with the indirect sparks applied along the spine over the lumbar region, and to the limbs, and, when the patient is a girl, over each ovarian region in front, for four or five minutes. When the patient is very nervous and excitable, and not in an anæmic condition, she is to be insulated with the negative pole instead of the positive.

Beneficial results may be obtained by using the galvanic in combination with static electricity. When using galvanism, the current should be applied to the entire length of the spine, one electrode being placed over the lumbar region and the other being passed down the spinal column.

The faradic current, applied in the form of general faradization, will prove of special value as a general tonic. An application of the secondary faradic current to the muscles chiefly affected will in many instances modify the excessive muscular twitchings.

Electricity is of special value in the treatment of chorea, on account of its *tonic* and *sedative* effects and its power of restoring the *nervous equilibrium.*

Agaricus.—Spasmodic movements, from simple involuntary motion and jerk of single muscles to a dancing of the whole body; involuntary movements *cease during sleep;* twitchings of the eyelids and of different parts of the body; the eyelids are in constant motion; twitching of the skin of the forehead, above right eye; twitching of head and cervical muscles on right side; chorea-like muscular motions of the scalp and temporal muscles; frequent jerking of the muscles in the extremities; constant twitching motion in the sacrum and lower extremities; idiotic expression of the countenance; inarticulate speech; difficult swallowing; weakness and coldness of the limbs; joints feel as if dislocated; spine sensitive to touch or to hot water.

Absinthium.—Twitching of the facial muscles and eyelids, and jerking and twitching of the muscles of the hands and lower limbs; sudden or flash-like jerks of the upper extremities, especially where there is a trembling of the hands; tingling sensation of the tongue, with sensation as if swollen and too large to move freely; dull occipital headache; fullness in the head; sleepy, yet unable to sleep; restless at night.

Arsenicum.—In simple, uncomplicated cases, no known remedy can equal arsenic in the form of Fowler's solution, two to four drops three times a day. Chronic, stubborn cases of chorea, the longer the disease has lasted the more deeply the organs and tissues have become affected, the more surely will arsenic be indicated; disordered and defective nutrition; pale waxy skin; great anxiety and restlessness; twitching, tremor, trembling and great weakness of the legs; uneasiness in the legs; has to change the position of the feet all the time, or walk about for relief; worse during rest at night; limbs feel heavy, and great fatigue; weakness of the feet, cannot stand.

Actea rac.—Actea is to be employed in chorea when the movements affect chiefly the left side; pain under the left breast; tenderness over the last cervical vertebræ; tenderness in the ovarian region; and especially when the disease is associated with myalgia or rheumatic ailments, or occurs reflexly as a result of uterine displacements; chorea occurring in young girls at or about the age of puberty, or when there are present symptoms indicative of menstrual disorders; chorea worse at the menstrual period; chorea of the heart; tumultuous, irregular, unexpected, and strange motions of the heart; aggravated by emotions; subsiding during sleep; cases of chorea associated with melancholia; mind greatly depressed; all the symptoms better from rest and warmth.

Belladonna.—Chorea resulting from fright or from reflex causes; epidemic chorea; violent congestion and heat in head, face flushed, throbbing of the carotids, wild look, dilated pupils, eyes congested; tendency to bore the head in the pillow; moaning and gritting of the teeth; mania, with crying, laughing, dancing; spasm of the throat, cannot swallow; trembling of the tongue; constant agitation; inability to stand erect; the patient is obliged to move to and fro, especially to move the hands and feet; cannot stand long in any position; jerking of the limbs; the predominant jerking is backward; this may alternate with a forward bending, convulsive movement of the limbs; hands and feet feel heavy; incontinence of urine; right side affected chiefly. The symptoms calling for belladonna are all noted for their intensity.

Causticum.—Chorea from the suppression of some exanthem, or when the result of cold or exposure; the right side of the body is chiefly affected; the muscles of the face, tongue, arm, and leg are all involved in the disorderly movements; speech is thick, and the words seem to be jerked out of the mouth; the patient is anxious and restless in bed at night, has to sit up and change his position; involuntarily throws his head about, and finally falls asleep exhausted. During sleep the legs and arms are constantly " on the go."

Cocculus.—Movements chiefly confined to the right side of the body, as the right arm or the right leg, with a tendency to paralysis of the affected part. Especially suited to nervous children of a lively turn of mind and thin, scrawny girls of irregular periods and subject to venous or hemorrhoidal congestions.

Cuprum.—Chorea major resulting from fright at start, and especially if the patient indulges in ludicrous gestures and tries to hide himself and crawl away. Periodical chorea, muscular contortions, with laughter, grimaces, exaltation, and ecstasies; twitching and irregular movements commencing in the fingers and toes; better when lying.

Hyoscyamus.—Twitching of certain groups of muscles of the face, the eyelids, the arms; every muscle of the body twitches and is thrown about, from the eyes to the toes; great agitation, disposed to laugh and to be talkative; patients seem to have abnormal impressions of distance; they reach for something that seems to be just within their grasp, when in reality it is on the other side of the room.

Ignatia.—Headache as if a nail were driven out through the side, relieved by lying on it; weight at the back of the head and a tendency of the head to incline backward against the back of a chair. Especially called for in chorea of emotional origin, as from fright, fear, grief, etc., and in girls nearing puberty. There is great excitability of mind and body; sighing and sobbing; the patient is sensitive, peevish, excitable, and strongly inclined to solitude, and to be very secretive and passive; anxiety as though something terrible had happened; imperfect sleep; palpitation of the heart; excessive urine. Most useful when the left side is affected; relieved by warmth and rest; aggravated by cold, motion, noise, and light.

Mygale lasidora (Cuban black spider poison).—It is considered almost a specific for chorea, whether in children or adults, in acute as well as chronic cases. According to Farrington, this is one of our best remedies for uncomplicated cases of chorea; patient is apt to be low spirited and depressed; complains of a dull pain in the forehead; the muscles of the face twitch; the mouth and eyes open and close in rapid succession; the head is often jerked to one side, usually to the right; there are also twitchings and jerkings of the muscles of one leg and arm, usually the right; control over the muscles is lost; the patient attempts to put the hand up to the head when the hand is violently jerked backward; gait unsteady; legs in motion while sitting and dragged while attempting to walk; constant motion of the whole body; an effort to talk is made, and the words are jerked out.

Nux vom.—Numbness, crawling in the affected parts; tottering and unsteadiness of the lower limbs; oppressive headache in the morning immediately after rising; mental impairment, loss of memory; unable to concentrate his thoughts or pursue his studies; irritable temperament; melancholy; sleepy and stupid in the evening before bedtime, but awakens an hour or two before daybreak and cannot sleep again; impaired appetite; faulty digestion; gastric eructations; furred tongue; constipation, with frequent, but ineffectual, desire to stool; stool clay-colored or black; symptoms all aggravated by touch, noise, motion, and cold air; relieved by warmth and by strong and steady pressure. Nux is especially useful in chronic cases.

Phosphorus.—Phosphorus may be used successfully in chorea when it occurs in children who are growing too fast; great weakness and prostration; child walks as if paralyzed; aphonia from paralysis of the laryngeal muscles; utter and complete exhaustion of mind and body; cannot walk, sit up, or talk.

Pulsatilla.—Chorea caused by amenorrhœa or dysmenorrhea; choreic movements occurring in young girls at or near puberty; despondent, weeps easily; she cannot sleep in the early part of the evening, but sleeps late in the morning (the opposite of nux); headache, chiefly in the forehead and supraorbital region, or in the temples; pains heavy, bursting, and throbbing; headache arising from the nape of the neck upward; aggravated by mental exertion, stooping, and in evening; vertigo comes on while sitting; vertigo and headache relieved by walking in the open air; tongue coated whitish yellow, with tenacious mucus; bitter, foul taste in the mouth in the morning.

Sepia.—Uterine chorea associated with menstrual irregularities; sudden jerking of the head backward and forward; eruptions like ringworms around the body.

Stramonium.—Child awakens from sleep terrified; it sings, laughs, or appears astonished, and does many silly and unusual things; there may even be stammering; tongue protruded rapidly; head thrown alternately backward and forward; spasmodic twisting of the spine and whole body; the extremities are in constant motion, though not always jerked, for sometimes their motion is rotary, gyratory, and even graceful; again there are irregular movements of the limbs, as, for example, the right arm and left leg; head and neck in constant motion; in fact, the muscles of the whole body may be in constant motion. The involuntary movements are greatest when awake, but may continue when asleep.

Tarantula.—Tarantula is indicated in chorea affecting the right arm and leg; head drawn downward; grimaces and contortions of the face and mouth; the movements even not ceasing at night; involuntary discharge of urine.

Zincum.—When chorea is caused by fright or suppressed eruptions, especially when the general health suffers very much; great depression of spirits; great irritability; the most severe forms of chorea where all the voluntary muscles of the face, trunk, and limbs are affected, so that the patient is unable to feed, dress, or bathe himself, and sometimes unable to walk.

Zizia.—Zizia causes an increase in the blood in the uterus, backache, smarting and burning in the back; spasmodic movements of the face and limbs; the mind is at first exhilarated, then depressed, and finally a state of indifference obtains. The most marked characteristic, however, is restless, choreic movements, *worse during sleep.*

Hereditary Chorea.

(*Huntington's Chorea.*)

This is a chronic, progressive form of chorea, occurring in the adult period of life; rarely met with under thirty-five. It is of an hereditary nature, running through many generations and affecting both sexes equally. The affection begins usually without any apparent cause, by twitching of the muscles of the face and upper extremities, which gradually become more severe as they extend. The muscular symptoms, in the main, correspond to those of ordinary chorea, but the mental changes are much more pronounced and unfavorable. It is rare for it not to be attended with some mental derangement, especially dementia. The symptoms usually continue during the remainder of the life of the patient. Nothing is definitely known of the pathology of this disease.

Convulsive Tic.

This is a disorder closely allied to chorea, termed by the French, " tic convulsif "; by Beard, " the jumpers "; by Hammond, " miryachit "; by Gray, " palmus." It is a nervous affection, characterized by motor inco-ordination and intermittent, sudden, shock-like movements of different muscles of the body or of the whole body. The face or the upper extremities are first affected; when the latter, it is unilateral. When the facial muscles are affected, it is manifested by a sudden wink, or a twitch of one cheek, occasionally of both, or of the brow. In the majority of cases the winking is bilateral. This series of movements is generally followed by a second series (much weaker), and sometimes even by a third.

About the same time the masseter muscles become implicated; by their contraction they cause a grating of the teeth or a projection of the tongue; this sudden spasmodic closing of the jaws may at times cause the tongue to be severely bitten. When the upper extremities are involved, it is first observed that the fingers are alternately extended and flexed. The muscles of the neck, taking part in the movement, cause the head to be retracted or drawn forward, or one shoulder is elevated. The lower extremities soon share in the general disturbance, but the inco-ordination in them is somewhat different, in that the movements are not limited to isolated muscular groups, but affect all the muscles of one limb and sometimes of both. All the movements are very sudden and very rapid, and each first set of movements is quickly followed by further ones.

During one of these series of movements the patient sometimes gives vent to an inarticulate cry, like " Hem! " or " Ah! " which sound may be repeated several times; in other cases, however, no cry is observed. Many of these cases involuntarily imitate whatever they see others do; for instance, if any one suddenly claps his hands, shouts, or jumps, they will imitate him precisely. Others will obey any command whatever that may be given them, regardless of the consequences; for instance, they will strike any one when told to do so, or they will repeat any word or sound that is made by the person so ordering. Beard says that he ordered one of the "jumpers," who was sitting in a chair with a knife in his hand, to throw the knife, and he threw it quickly, so that it stuck in a house opposite; at the same time he repeated the order to throw it, with a cry of alarm not unlike that of hysteria or epilepsy. Two " jumpers " standing near each other were told to strike, and they struck each other very forcibly. The pathology of this affection is unknown. The diagnosis usually is not difficult. The only disease with which it is likely to be confounded is chorea; but in chorea the movements are always fibrillary or wave-like, while in this affection they are sudden and shock-like, with much longer intermissions. The prognosis, as a rule, in fully developed cases, is unfavorable; but in the milder forms and in the earlier stages the disease is amenable to treatment. The treatment for the mider forms and in the earlier stages is, in the main, similar to that of chorea.

Hysteria.

Hysteria is a term derived from a Greek word signifying " the womb," from the idea that the disease was due to disorder of the uterine system.

Hysteria is a functional disease of the higher cerebral centers, manifested by derangement of the sensory or motor functions and at times those of the sympathetic system, and is a condition in which volition is depressed and emotions exalted, accompanied by constantly changing symptoms which may assimilate any known disease. In hysteria we have what has been called the " mocking-bird " of nerve disease, so that every symptom which may be the result of disease or destruction of the nervous system may be simulated by hysteria. Hysteria is the most typical of all the so-called "functional diseases." It is a disease in which the public generally is of the belief that the patient could prevent it if she so chose. In many of the cases this is true to a certain extent, but in the majority of cases the malady is a real one and beyond the direct influence of the patient's will; for the hysteric really feels and experiences all the disagreeable sensations and morbid symptoms which she describes; so that the physician should disabuse his mind entirely of the idea that hysteria is a caprice and not a disease. The term " hysteria " is, however, too often used as a mere cloak for ignorance, an excuse for not thinking. To call certain abnormal phenomena "hysterical" and imagine that this explains them is not sufficient. We must search for the cause of the phenomena. The affection which is called hysteria when occurring in the female is known by the term *hypochondria* when occurring in the male.

Ætiology.—SEX.—It is much more frequent in females than in males. This is due not only to the fact of the greater impressionability of their nervous system, but also on account of their sexual organs being more easily deranged and liable to such diseases as displacements of the womb, ulceration or laceration of the cervix, diseases of the ovaries, and menstrual disorders. There is but little doubt that undue excitation of the functions of the ovaries has more to do with the production of hysteria than any other cause.

HEREDITY.—Of the predisposing causes, heredity is the most important. In about seventy-five per cent. there is a history of hysteria or some neurosis or psychosis in the patients. It may be directly transmitted, or may be inherited from the general neurotic tendency, such as insanity, epilepsy, sick headache, neuralgia, etc. The disease is transmitted more often by the mother than by the father.

RACE AND CIVILIZATION.—The more highly the grade of civilization, the more frequently is hysteria met with; rarely ever occurring among barbarous races. It seems to be a product of the cerebral development that accompanies the process of civilization, because the higher civilization induces a restless mental activity, with its attendant emotional strains. In the French, hysteria is met with in its most perfect type.

Hysteria is a disease of early adult life, most cases occurring between the ages of fifteen and twenty-five. It may also be met with occasionally in children. Anæmia and defective general health may act as predisposing causes. Imitation has been known to cause hysterical attacks in schools, workhouses, hospitals, etc. Injuries, combined usually with mental shock, may act as a cause; for instance, an injury to a limb from a blow or fall may be followed by pain, anæsthesia, paralysis, and contracture purely of an hysterical type. Psychical influences, such as anxiety, fear, disappointed love, regret, care, and jealousy often give rise to hysteria.

Many cases of hysteria are undoubtedly caused by pathological changes in the rectum, such as piles, pockets, papillæ, a too constricted sphincter, an anæmic or hyperæmic mucous membrane, atrophy of the mucous membrane of the rectum or of one of the orifices; also, " a stenosed canal."

Symptoms.—For convenience of description, the symptoms may be arranged under five headings—(1) Psychical, (2) Sensory, (3) Motor, (4) Vasomotor, (5) Visceral.

PSYCHICAL SYMPTOMS.—The mental symptoms are infinite in character and variety, being manifested by emotional disturbances, defective power of will, the lack of self-control, inability to resist the impulse of inclination, irritability of temper, illusions, hallucinations, delusions, ecstasy, melancholia, trance, or mania. Self-consciousness dominates more or less completely the patient's thoughts and even actions, and finds its expression in manner, glance, and tone; if she cannot get sympathy in one way, she will try another. (Some cases attitudinize and do everything to attract attention to themselves.) The patient has a morbid desire for sympathy or for attracting attention, and tries to impress others with the belief that she is very ill. The attention she receives is a new stimulus to her self-consciousness. It must not, however, be inferred that all mimicry is intentional simulation. The nervous system is dominated by *idea* and by *fear* as well as by *desire*. The idea of a loss of power may render it impossible for the patient to will the movement; the conception of a muscular spasm may induce the contractions; and if a definite pain is thought of, before long it may be felt, without the symptoms being in any case intentionally induced. (Gowers.)

The mere idea of pain is enough to bring on actual pain in some persons; and the mind can so modify and exaggerate it as to give it reality through sensation. Real disease can be produced by the imagination, not only functional, but in some instances lesions of tissue. The influence of the mind upon the body is well illustrated in the following case: Bernheim upon one occasion applied a postage stamp to the back of a patient and told him that it was a fly plaster. It produced a blister as well as if it had been a genuine fly plaster. Other cases may manifest perfect apathy to external surroundings. In still other cases there may be alternations of laughing and crying.

SENSORY SYMPTOMS.—These may be manifested by hyperæsthesia, neuralgia, or anæsthesia. The hyperæsthesia may be confined to one-half of the body, one arm or one leg, the back, the abdominal wall, or individual joints; rarely does it extend over the entire surface of the body. Hyperæsthesia of the special senses is frequently met with; the eye becomes extremely sensitive to light, the ear to the slightest noise.

Pain is often felt in various parts, such as the head, the chest, the back, the abdomen, the limbs, or the joints. Hemicrania is very frequent, especially in the left side, and from the sensation as if a nail were being driven in it is termed "*clavus hystericus.*" There are certain spots of tenderness, termed by Richer "hystero-genic" spots, upon which pressure will produce intolerable pain. One of the most frequent of these spots is the ovarian region—the left more frequently. Quite frequently the spine is the seat of the tenderness, especially the upper, middle, or dorsal region. The abdomen may be the seat of the tenderness, simulating the tenderness of peritoneal inflammation. No disease simulates peritonitis more closely than hysteria. The abdomen may be extremely painful to touch, swollen, and distended with gas. In these cases, however, deep pressure produces no more pain than the slightest touch; the pain is not increased by deep inspiration, by coughing, or by extending the thighs. Then the history of the case usually points toward an hysterical tendency. Pains in the joints (usually the hip and knee) may simulate arthritis, especially when accompanied by contracture of the limb and by swelling and œdema of the surrounding parts.* There may have been some physical cause for the feeling, and the concentration of attention upon the weak spot may have exalted its sensitiveness to a diseased point. That peculiar pain in the left side which distresses so many women is usually of hysterical origin; also the pains in the infra-mammary regions are of the same origin. At other times neuralgia of an hysterical origin may be in the form of a pain over the heart (cardialgia); pain over the ovaries (ovarialgia), sciatica, or pain in the course of any other nerve.

Other sensations, subjective in character, such as pricking, tingling, or numbness of the limbs, may be complained of; or there may be a cold creeping sensation up and down the spine, or a sensation of cold water trickling down the spine; still other cases complain of sensations such as noises in the ears, flashes of light, and sensations of taste or smell.

Anæsthesia is quite a common manifestation of hysteria, although not so frequently met with as hyperæsthesia. It may affect one-half of the body, one arm, one leg, etc. Not only may the skin be anæsthetic, but also the mucous membrane of the nose, mouth, larynx, pharynx, and vagina. When the anæsthesia is more profound, the muscular tissues become involved. The abolition of sensation may also involve the larger and smaller joints of the limbs and trunk as well as the bones. The anæsthetic region is sometimes interspersed with small spots in which sensibility remains intact. The parts affected may have lost their sensibility to touch, pain, temperature, and muscular sense; or, again, the sensation of touch is lost, and of pain only lessened. When the anæsthesia is complete, a touch cannot be felt, a needle may be run into the skin without causing any sensation, neither cold nor heat can be perceived, and the skin may even be wounded or burned and the patient is unconscious of pain. The area affected may vary from day to day, or be present one day and gone the next, or may change from one side to the other. The special senses may become involved. There may be impairment or loss of hearing, or there may be partial or complete loss of sight; usually this is only of temporary occurrence, passing off in a few days or weeks; rarely it may be permanent. In either case the loss is usually sudden and may follow an hysterical attack or a severe fright or alarm. Gowers mentions the case of a lady who was always peculiarly sensitive to thunder storms, although not specially alarmed at them; she could always foretell a coming storm with remarkable accuracy. During one severe storm she became suddenly blind. There was no suspicion of a lightning stroke. Vision never returned. The hypothesis which seems best to explain these phenomena is that the emotional shock causes a temporary functional perversion of the special senses, which in rare instances may result in structural changes.

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* Hilton ("Rest and Pain") gives the following explanation of hysterical pains in the hip- or knee-joint: "The sacral ganglia and the lower lumbar ganglia of the sympathetic nerve are connected with the great sciatic nerve, and partly also with the obturator nerve. These same ganglia are connected likewise with the nerves proceeding through the broad ligament through the uterus and to the ovaries. I think we have here, then, an explanation of the frequent occurrence of what we call hysterical hip-joint or hysterical knee-joint. If the nerves in the ovaries or the uterus be in a state of irritation, that irritation can be conducted to the sacral nerves or to the obturator, and then, in accordance with the generally received law of distribution of nervous influence, irritation or pain may be manifested at the other peripheral or articular end of the same nerve. Hence, it may be expressed within the knee-joint, on the inner side of the knee-joint, or it may be within the hip-joint, because the hip-joint as well as that of the knee receives its nerves from these various sources."

MOTOR SYMPTOMS.—The motor disorder consists either of irritation of the motor functions, as in *spasms* and *contractures*, or of diminution or even complete abolition of these functions, as in *paresis* and *paralysis*.

HYSTERICAL SPASMS.—The spasms may be either tonic or clonic, and may affect any muscle of the body. Clonic hysterical spasms are manifested by an hysterical cough, hysterical asthma, hiccough, facial spasms, etc. The tonic variety of spasms may cause contracture of the limbs, thereby resulting in deformities; or contracture of the muscles of the neck, causing torticollis or "wry-neck."

In the pharynx tonic spasms cause the sensation to which the term " globus hystericus " is applied, and which gives rise to a sensation as if a ball started in the stomach and passed up to the throat, causing a feeling of suffocation.

Tonic spasm of the esophagus may cause dysphagia or difficult swallowing, which may simulate real stricture of the esophagus. The nervous character of the disease, however, is often evidenced by the influence of the emotions on the character of the symptoms—the difficulty in swallowing being greatly increased by expressions of sympathy. In many cases, the spasm excited by the act of swallowing soon yields and the food passes down; others, however, eject all food, and the patients slowly starve to death unless rectal alimentation is resorted to. In organic stricture the introduction of a bougie meets with resistance, but by continuous and gentle pressure stricture due to hysterical spasms invariably yields.

Spasms of the vagina (vaginismus) which prevent sexual intercourse, strabismus or " cross-eye " which may be transient or permanent, and spasms of the bladder and rectum may all result from hysterical tonic spasms. Hysterical trismus, or lock-jaw, is due to a contraction of the muscles of mastication. The so called hysterical joint may be classed among the motor symptoms. It is not attended with swelling, redness, or great painfulness, as in organic joint troubles. It is met with more frequently in the knee-joint than in the other joints.

HYSTERICAL PARALYSIS.—Hysterical paralysis may assume the form of a monoplegia, hemiplegia, or paraplegia. The loss of power is rarely ever complete. The limbs can be moved about at will, but when they attempt to lift anything, or to stand, the limbs fail them. In many cases, however, they can manage to move about the room by clinging to articles of furniture or with the assistance of a cane. The feet are dragged or shuffled along, one foot usually being affected more than its fellow. The knee-jerk may be normal, but more usually is exaggerated. Duchenne has found the electric excitability of the muscles normal in all cases of hysterical paralysis, while the electromuscular sensibility (that is, the sensation excited by the electro-muscular contractions) was nearly or totally gone. Ataxia of movement occurs quite frequently in hysterical subjects. The facial muscles are rarely ever affected, excepting those of the eye, causing ptosis and alternating strabismus.

Hysterical aphonia is due to paralysis of the larynx resulting in a loss of the voice, the patient not being able to speak above a whisper. It often comes on very suddenly and as suddenly disappears.

Weir Mitchell has called attention to the fact that a contracture of a muscle or a part of a muscle may give rise to a local " tumor " simulating a morbid growth. This occurs most frequently in the calf of the leg and in the pectoralis major. Gowers speaks of " phantom tumors " of the abdomen, in which the middle part of the belly, usually below the umbilicus, becomes prominent and appears as if bulged forward by a mass within. The mechanism by which it is produced appears to be a relaxation of the rectus and a spasmodic contraction of the diaphragm; the intestines, often distended with flatus, are pushed forward in the region where the wall is lax. Occasionally the enlargement of the abdomen is general. These various forms of tumors usually subside under the influence of chloroform.

VASOMOTOR SYMPTOMS.—These may consist of local swellings or œdema, appearing suddenly without cause and disappearing as suddenly. These occur especially about the hands or feet, or about joints; other symptoms are vicarious hemorrhage from the stomach, taking the place of the menstrual flow; elevation of the temperature at some period of the day; a dry, scurfy skin; polyuria, the passing of large quantities of pale urine. The heart's action may be irregular and too frequent; palpitation of the heart, accompanied by a sensation of " sinking " and dyspnœa and pain in the back. There may be alternations of flushing and pallor of the face. The face may be red and burning while the feet and hands are cold, or the feet may be alternately hot and cold.

VISCERAL SYMPTOMS.—Abnormal respiration, rapid breathing, fifty, sixty, or eighty respirations per minute, may be met with as a purely hysterical symptom. The digestive organs are affected in various ways. Certain patients take very little nourishment, experience profound disgust for certain dishes, and may even abstain entirely from food for a longer or shorter period; other patients have an unnatural craving for food (boulimia); still others suffer from an obstinate form of vomiting—nothing seems to stay in the stomach. Dyspepsia in every form and degree may be met with; flatulence, gastric and intestinal, is a very common annoyance; constipation is a troublesome complication; retention of urine may occur and require the prolonged use of the catheter; complete suppression may last for several days without giving rise to uræmic intoxication; rarely, if ever, is there incontinence of urine.

HYSTERICAL CONVULSIONS.—The convulsions may be partial, affecting one limb or more, or general, affecting all the limbs, head, and body. There may or may not be loss of consciousness. The attack may be preceded by certain premonitory symptoms, such as languor, malaise, anorexia, tingling or slight pain in the limbs, vesical tenesmus, a feeling of oppression in the epigastrium, or mental disturbance with hallucinations; these are quickly followed by palpitation of the heart, feeling of suffocation, spasm of the larynx (globus hystericus), and then the convulsive stage sets in. In very mild cases the patient throws the limbs about, or rolls over, or strikes out, or kicks. The movements are, however, of a purposive character. The loss of consciousness is seldom complete, so that the patients never fall in such a way as to injure themselves; the special senses are less involved than in the severe attacks; the patient is unable to speak, or perform any voluntary movement, or to give any sign of intelligence. In a severe attack the onset is attended with sudden loss of consciousness and general clonic spasms; the patient gives utterance to a piercing cry: the face becomes pale and grimacing; tonic and clonic contractions succeeding one another rapidly in the muscles of the face, eyes, jaws, in the limbs of one or both sides, and in the muscles of the back, thorax, and abdomen. When it assumes the tonic variety, there is rigid fixation of the trunk and limbs, and often opisthotonos; this may be so severe that the patient rests on the back of the head and heels. This is soon followed by wild movements in which the limbs are thrown about with great force and rapidity; the patient screams, fights, cries, or writhes in contortions.

The attack, which may last for a few minutes or several hours, ends either by a shower of tears, by an abundant development of gas in the stomach and intestines, or by the emission of a large quantity of pale, inodorous urine, leaving the patient in a condition of exhaustion; or it is followed by a stage of mental and emotional disturbance; she is delirious, sees all manner of strange objects, or assumes peculiar attitudes, as of the cross, etc. The patient finally sinks into profound sleep or coma, which may last from twelve to twenty-four hours. According to Charcot, many of these attacks can be stopped by pressing upon the ovarian region, or by an electric shock.

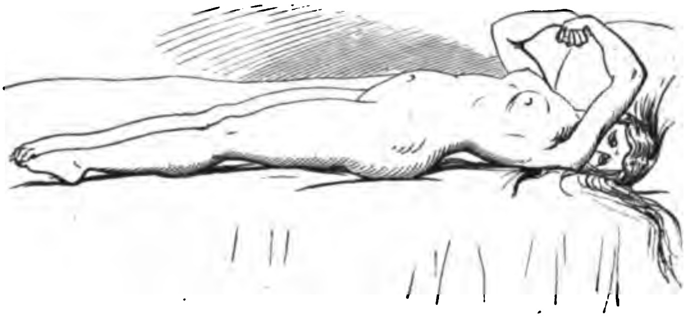

FIG. 73.—HYSTERICAL CONVULSIONS.

Pathology.—The pathology is entirely unknown. The examination of the nervous system in hysteria has merely given negative results; true, lesions of various characters have been found in the brain and spinal cord on *post-mortem*, in patients that have suffered from severe forms of hysteria, but these must be regarded as the result of the functional disturbances or as accidental concomitants.

We should go a step farther and look for morbid conditions elsewhere. There are very few instances of severe and prolonged cases of hysteria, but what have disease of the genital organs or some pathological change in some one of the orifices of the body. Scanzoni found 1328 cases of hysteria among 1724 women affected with disease of the genital organs. If he had gone further and examined under the calcium search-light of *orificial methods*, this number would undoubtedly have been greatly exceeded.

Diagnosis.—In the main, the diagnosis of hysteria is not a difficult task. There are cases, however, in which it is a far more difficult matter to distinguish between hysterical and organic diseases of the nervous system than is generally supposed, and often very serious mistakes have been made. The symptoms of hysteria are varied and complicated. There is hardly a disease of the nervous system which hysteria may not simulate, and often a true diagnosis can be arrived at only by the exclusion of more serious conditions.

Prognosis.—The prognosis varies according as to whether it is due to hereditary influence or exciting causes; being less favorable in hereditary cases, many of them passing into dementia or insanity. The greater majority of cases, however, are curable. Hysteria very rarely endangers life. Death may occur, however, from suffocation during an attack of spasm of the glottis, from cerebral hemorrhage, from syncope, from exhaustion, or from an intercurrent disease in debilitated patients.

Treatment.—The first element in treatment is the removal of whatever defect in the general health or local disorder of function can be discovered. It is a self-evident fact that some form of reflex irritation exists in a very large proportion of hysterical subjects, and its detection and removal constitutes the first duty of a physician. So positive am I that this reflex irritation exists that seldom do I begin the treatment of a case without a thorough examination of all the orifices of the body.

Many of the cases will be relieved simply by a dilatation of the sphincters, either by means of the bivalve speculum or by the use of the rectal plugs; other cases, however, will require more radical measures; piles will have to be removed, pockets and papillæ clipped out, or again, in many cases, you will have to go still farther, and perform the American operation. In females the clitoris will have to be unhooded, the cervical canal dilated, and any laceration repaired; in males the urethra may have to be dilated or circumcision performed. Many cases that have for years resisted all forms of treatment respond as if by magic after this line of treatment has been followed out, and in a few weeks or months are perfectly cured. It will not cure every case, but will pave the way for your indicated remedy, or for other treatment to follow. Remedies whose action before was apparently inert will now give you good satisfaction.

In electricity we have a valuable adjunct. Many of these cases, especially paralysis and contracture, can be relieved almost instantly with the heavy static spark; the patient being negatively insulated, apply the positive pole to the contracted limb. Ofttimes patients that have had a contractured limb which they have been unable to straighten out or use for weeks or months, after one application to the limbs with the sparks, will throw down their cane and walk out of the room; but, in the majority of cases, the contracture will return as soon as the moral and sensory impressions pass off; by repeated applications, however, this tendency will be overcome.

These are the forms of paralysis " cured " by the long-haired so called " magic doctors," who, amid the plaudits of a wondering audience (and usually the music of a string band), cause their patients to throw away their crutches and walk off the stage; but they usually, however, have to hunt them up the next morning.

Any strong emotional disturbance, as fright, etc., will often dispel this paralysis. In case of fire or a burning house, bedridden patients have been known to get up and run out of the house.

Static electricity often gives successful results in the treatment of the sensory as well as the motor symptoms. The sparks should be applied directly to the seat of the pain. Many cases of anæsthesia can be relieved by means of this form of electricity. The anæsthesia will often disappear after each sitting and then return again after various intervals. In the majority of cases, however, where the treatments are persisted in, sensibility is completely and permanently restored. In many cases the general physical condition needs to be treated as much as, if not more than, the motor and sensory phenomena. These cases are best treated by static insulation. In using insulation, the question as to whether positive or negative insulation shall be used must be decided by the special indications in each individual case. As a general rule, however, when the patient is anæmic, "run down," positive insulation will be called for, while, on the other hand, if the patient is excessively nervous, negative insulation will give better results. Static insulation with the head breeze, followed by mild sparks, acts as a general tonic and gives a refreshing and invigorating effect.

When using the galvanic current place one pole (usually the negative) on some indifferent part of the body and the other pole (the positive) directly over the painful spot. If the spine is the seat of tenderness, the positive pole should be moved up and down the spine. The various forms of neuralgia yield to the galvanic currents more readily than to the other currents—in fact, many of them being dissipated as if by magic. There is no method of treating neuralgia that compares with electricity.

In many of these cases of hysteria, where we desire the influence of a constitutional tonic, general faradization will be called for and will often prove more successful than anything else. Anæsthesia will yield more quickly to faradism than to either of the other currents. There are several ways of using faradism for this affection, but the application of the wire brush is the most effective, as it causes the most intense stimulation. Dysphagia is best treated by the faradic current; this can be applied externally—an electrode placed on either side of the pharynx—or an internal application may be made by means of a catheter-shaped electrode applied to the constrictors of the pharynx.

Aphonia may often be relieved by a single sitting, but the tendency is for it to return time and again. Either the faradic or static current may be used; if the faradic, place one pole on either side of the pharynx externally; if the static, insulate the patient and apply the sparks mildly.

Contractures are not, as a rule, benefited by electricity; but in many instances faradism applied to the contracted limb will cause it to relax. Rubbing, combined with gentle passive movements, will often prove of great benefit in these cases. It is well known that a local shock from other means aside from electricity, such as the actual cautery, a cold douche, etc., will sometimes cure hysterical symptoms. (Rockwell.)

In many instances nothing can be done to improve the patient's condition as long as she is surrounded by too sympathetic friends, who bewail the patient's sufferings. This may be sufficient to undo all, and more, too, that the most skillful physician can accomplish. In the milder forms of hysteria a change of scenery, a trip to the country or to the mountains, will often facilitate matters. In severe cases often the patient will have to be taken away from home, placed in the charge of a trained nurse, and isolated from all friends. The isolation is not only of great influence in itself, but affords an opportunity for influencing the mind. The rest-and-seclusion treatment of Weir Mitchell will prove of benefit in many of these cases, especially the bed-ridden type. He advises keeping the patient absolutely at rest in bed and obtaining the tonic influence of exercise by daily massage and electricity—skilled rubbing, and kneading the muscles and putting them in action by faradism; at the same time abundance of food being given in an easily digested form. The strongest moral influence must be brought to bear, and unhealthy mental surroundings removed. The moral treatment of hysteria will call for the exercise of much intelligence, tact, firmness, and knowledge of human nature. The object of moral treatment is to restore to the will its control, which it has lost. It is here that our best and most effective work must be done; it is here that every case is especially individualized. The physician should gain the confidence of the patient by the infinite number of devices that will suggest themselves to a physician of experience and knowledge of human nature; when this is done, the battle is half won. The patient must be made to realize that deliberate endeavor, fruitless at first, will be effectual at last. She must be taught, bit by bit, to do many things that she had thought impossible; these must be accomplished gradually and slowly. She must understand that her sensations, however alarming they may seem, are not as serious as if they depended upon an organic lesion; that her disease, being purely a functional one, can be perfectly cured. Never accuse an hysteric of deception nor tell her that she can stop the symptoms by mere volition. She cannot by a deliberate effort of the will ignore the sensations that distress her, but she should be encouraged to try to neglect them by directing her attention to other subjects. As long as the influence of attention is at work, the patient's distress continues, and the mental cause is beyond the influence of drugs. The great fundamental principle of moral treatment lies in the realm of suggestive therapeutics; by this it is not intended to infer that it is necessary to hypnotize them, but, as Delamater says, there are a few cases that you cannot cure until you first get them into that condition where their subjective mind is in the ascendency for the time being.

In regard to the therapeutical treatment, it would be a waste of time and space to undertake to give *all* the remedies called for in this affection; as has been stated, it simulates nearly every form of nervous trouble, and consequently would call for almost every remedy in the materia medica; in fact, it would be easier to give the remedies that were *not* called for; however, the following are a few that are the most frequently indicated and will prove of the greatest benefit. The remedies should be selected not for the transient symptoms alone, but for the individual, the fundamental, and the abiding tendencies, and without reference as to whether they are classed as hysterical remedies or not.

Actea racemosa.—Melancholia; exceedingly nervous; sleeplessness and very sensitive; sees imaginary strange objects in the room; great apprehensiveness; feels grieved; troubled with sighing; a sensation of heat on the top of the head just back of the center; a feeling as if the top of the head would fly off; sharp lancinating and neuralgiform pains in and over the eyes; supra-orbital pains shooting up to the top of the head; neuralgia changing to various parts of the body as a reflex symptom from *uterine* or *ovarian* disease; ovarian neuralgia where the pains change their place often; mammary or infra-mammary pains of a burning nature, worse on the left side; hyperæsthesia of a rheumatic character after going to bed; jerking, commencing on the side on which she is lying, compelling change of position; nervous shudderings and nervous chills.

Apis.—Fidgetiness, restlessness, excitability, and ill-timed laughing; fickleness at work; nervous and awkward; it is not a natural awkwardness but one that comes from inco-ordination of the muscles. Especially indicated in young girls at the age of puberty with amenorrhœa, bearing down in the uterine region, congestion of the head, face flushed, sensation of suffocation, sexual passion too active, and they are prone to jealousy.

Asafetida.—Asafetida produces a sensation as though a ball started in the stomach and rose into the throat (globus hystericus); a bursting feeling upward as though everything in the abdomen was coming out at the mouth (a characteristic symptom of hysterical colic): palpitation; spasmodic tightness of the chest, as if the lungs could not be fully expanded; flatus accumulates in the abdomen, presses up against the lungs, and produces oppression of breathing; belching, and rancid eructations, greasy taste; burning in the stomach and esophagus; an empty gone feeling in the stomach at 11 a. m.

Belladonna.—Belladonna is called for in cases where the paroxysms occur at the menstrual period, which is painful and attended by severe frontal headache, aggravated by noise, motion, or light; also indicated in hysterical states where the patient is boisterous and wild; rush of blood to the head during spasmodic attack, with redness of face and eyes; sleepiness but cannot sleep.

Gelsemium.—The grand center of action for this remedy is upon the *motor* portion of the *spinal cord, paralyzing motility* first, and then *sensibility.* The two most prominent symptoms caused by this drug are *convulsions* and *paralysis.* This remedy is adapted especially to nervous, excitable, hysterical persons, with excessive irritability of mind and body; languor; prostration; nervous headaches commencing in the neck and spreading over the whole head; headache may come on suddenly, with dimness of sight or double vision; vertigo; great heaviness of head, it feels too big, and too light; sensation as of a band drawn tightly around the head above the ears, with a feeling of great soreness of the scalp and brain; semi-stupor; heavy expression; paralysis of the eyelids; heaviness, impossible to raise the lids; eyeballs oscillate laterally when using them; irritative, convulsive spasmodic cough without expectoration; spasms of various muscles throughout the body; paralytic condition of the lumbar and sacral muscles; heaviness, weight, loss of voluntary motion; muscles will not obey the will; numbness, feeling as if the limbs were going to sleep.

Hyoscyamus.—Called for when the mental condition of the patient exhibits marked jealousy; she is full of suspicion; she fears that she will be poisoned and may, on that account, refuse all food or medicine; or much silly laughter and foolish actions; jerking and twitching in the muscles; irregular menses.

Ignatia.—Of all our remedies none so completely corresponds to hysteria and so often cures it as ignatia. Studying the action of ignatia we find that its greatest force is expended upon the cerebro-spinal system. It produces spasms especially of the *clonic* type, twitchings and convulsions. It acts upon the vital powers more than upon the organic substances of the body. It destroys the harmony of action between the different organisms, preventing the *co-ordination of functions*. The nervous system is over-impressionable, inco-ordinate in function, and contradictory in action. The patient is extremely susceptible to emotional influences; fear and grief affect her seriously; the least contradiction offends; she is readily chagrined, and so is often reduced to grief and tears by the slightest cause. The moods change with wonderful rapidity; now she laughs and jokes, then quickly she bursts into tears; sometimes the laughing becomes spasmodic and ends in screams and even spasms of the chest with blueness of the face. She dwells upon her troubles in secret and silence, and broods over them until they prey upon the whole system. Her manner becomes hurried so that everything is performed hastily, and hence imperfectly and awkwardly; there is palpitation of the heart; face flushes at every emotion; intense headache, characterized by pressure; the pain goes to the eye (usually the left), which feels as if pressed out; or to the root of the nose; or again it is confined to one small spot, as though a nail were being driven into that spot (clavus hystericus); it is often periodical, returning every two or three days, increases gradually in severity and then suddenly abates. At the height of the paroxysms, the patient becomes restless and chilly and finally a profuse flow of colorless urine terminates the attack.

Lilium tig.—Increased sexual desire; great bearing down in the uterine region with a sensation as if the whole pelvic contents would issue through the vagina, if not prevented by upward pressure of the hand on the vulva; severe pain in the left ovary, running down the left limb; thin, brown, acrid leucorrhea; constant pressure on the rectum and bladder, causing frequent desire to go to stool; frequent urination, followed by smarting and burning in the urethra; sharp, sudden pain in the left chest with a sensation as if the heart was grasped, interrupting the heart's action and respiration, believes her disease to be incurable; that she has some organic disease that nobody understands; disposition to curse, to strike, to think of obscene things. This remedy has no superior in hysteria with uterine displacements, and marked ovarian irritation, complicated by frequent neuralgic attacks of the left ovary.

Magnesia mur.—After eating, suffers from nausea and eructations; sensation as of a ball rising from the stomach into the throat; throbbing and fainting spells; relieved by eructations; congestive headaches with a sensation as of boiling water in the cranium, or as a frontal numbness, relieved by firm pressure with the hands, or after wrapping the head up warmly; bearing down in the uterine region and uterine spasms; menses black and pitch-like and are accompanied by pain in the back when walking and in the thighs when sitting; constipation of large, difficult stools; being composed of hard lumps, or they are so dry that they crumble as they pass the verge of the anus.

Moschus.—Particularly suited when the patient faints easily; irritable, cross, scolding disposition; scolds until lips are blue, face pale, surface cold, and she foams at the mouth; falls in a swoon to the floor; violent palpitation; suffocative paroxysms; fear of death; vertigo, objects turn in a circle, worse when the eyes are closed; headache, as from a weight pressing here and there on the head; pains in the back and limbs; pains expressed by a sensation of tension, stiffness, pressure and drawing; muscular twitching; ataxia; convulsions more tonic than clonic; menses too early and too profuse, preceded by a tense drawing or bearing down pain; great tympanites; copius, pale urine.

Nux vom.—She seldom sleeps after 3 a. m., but dozes after five, and late in the morning; sleep unrefreshing; oversensitiveness, every harmless word offends; irritable temperament; quarrelsome even to violence; dyspeptic, cannot bear any kind of stimulants or highly seasoned food; feeling of weight in stomach after eating; flatulent distention of the abdomen after eating; constipation with frequent but ineffectual desire for stool; or large difficult stools; menses irregular, never at the right time; tingling, hard, aching, sticking pains, especially aggravated by contact; great weariness and relaxation of all the limbs; sensation of sudden loss of power; tottering and unsteadiness of the lower extremities; paralysis, with numbness and coldness of the paralyzed parts.

Pulsatilla.—Fearful, sad, melancholy; she does not, like the ignatia subject, nurse her troubles in seclusion, but makes her grief known to everyone that comes near her; she seeks sympathy; she is timid and yielding in her disposition; scanty menses; profuse watery urine.

Phos. acid.—Chronic, long-lasting grief; great sense of weakness; she complains of night sweats, not from organic disease, but from sheer exhaustion; has little or no appetite, and complains of a sensation as of heavy pressure on the top of the head, as though a load lay there; emaciation; ennui.

Platina.—Demonstrative, self-exaltation and contempt for others; suffers greatly from headaches; the headaches are of a constrictive character; a squeezing, cramp-like pain, with numbness, and the pains gradually increase and as gradually decrease; pains in the root of the nose as though the parts were squeezed in a vice; neuralgias in various parts; the pains are of a crampy character, followed by numbness and tingling in the parts affected; spasm of the esophagus, dyspnœa; spasmodic asthma.

Palladium.—Palladium is distinguished by its unique mental phenomena. She is irritable, impatient, given to strange and violent language. Music, society, or animated conversation excites her and produces pains in the right ovary; the following day she feels correspondingly used up. Her egotism is displayed in fondness for the good opinion of others; hence she is continually getting "slighted." She imagines herself neglected, her pride wounded; easily excited and very impatient. The uterine symptoms are characterized by a weakness as if the womb were sinking; empty feeling in the groins, as if eviscerated.

Sanguinaria.—Hyperæsthesia of the auditory nerve; painful sensitiveness, especially to sudden sounds; sensation as if the patient was in a railroad car, or in some vehicle which was moving and jarring her, with a feeling as if all about her were talking rapidly and confusedly. The sense of smell is increased, and there is a peculiar susceptibility to odors which causes the patient to faint.

Sepia.—Low spirited, sad, and cries readily; the sadness associated with irritability; at other times cool indifference; she does not care for her household affairs, or even for her own family; headache, pain over one eye (it may be either) of a throbbing character; deep, stitching pains which seem to be in the membranes of the brain; pain shooting upward or from within outward; the pains recur in shocks or flashes; she is troubled with palpitation, oppressed feeling and faintness; great languor; flashes of heat, which seem to begin about the trunk and go upward to the head, ending in perspiration; throbbing in the epigastrium and in the uterine region; hands hot, feet cold, or as soon as the feet become hot the hands become cold; scanty menstruation; nose bleed from suppressed menses; tongue coated white; bowels usually constipated, stools being hard, dry, and expelled with great difficulty; abdomen bloated.

Tarantula.—Sadness, indifference, profound melancholy, or cunning attempts to feign paroxysms and wild dancing.

Valerina.—Both mind and body are in a condition of irritation and excessive nervous excitability; fearfulness and tremulousness, with palpitation of the heart; hyperæsthesia of all the senses; the patient is lively, joyous, talking rapidly; at times imagines she is beset with danger or surrounding objects seem strange; headache, head feels full to bursting; the slightest exertion causes violent headache; restlessness, cannot keep quiet, she must move; tingling, drawing, cramp-like, stinging, or darting, tearing pains, all worse when sitting; better when she moves about; pains simulate those of rheumatism; she is wide awake and restless all night, falling into a dreamy sleep toward morning; flushes of heat.

Zincum.—Incessant and violent fidgety feeling in the feet and lower extremities; she must move them constantly; moving the feet for hours after retiring, even continuing in sleep; variable mood; aversion to mental or bodily exertion. This remedy is of special value in chronic cases of uterine disease and somnambulists.

Catalepsy.

Catalepsy is a functional disease, closely allied to hysteria, and characterized by a sudden suspension of thought, by loss of sensation, and by loss of voluntary motion, and during which there is a peculiar " wax-like " rigidity of the muscles. The limbs remain in the position in which they were at the outset of the attack, or in any attitude in which they may be placed, until they finally yield to the action of the force of gravity. The countenance is usually expressionless, and the whole body remains as if petrified; the eyes wide open; the pupils, although dilated, are very susceptible to light; consciousness may or may not be entirely lost. The patient may have been perfectly cog-

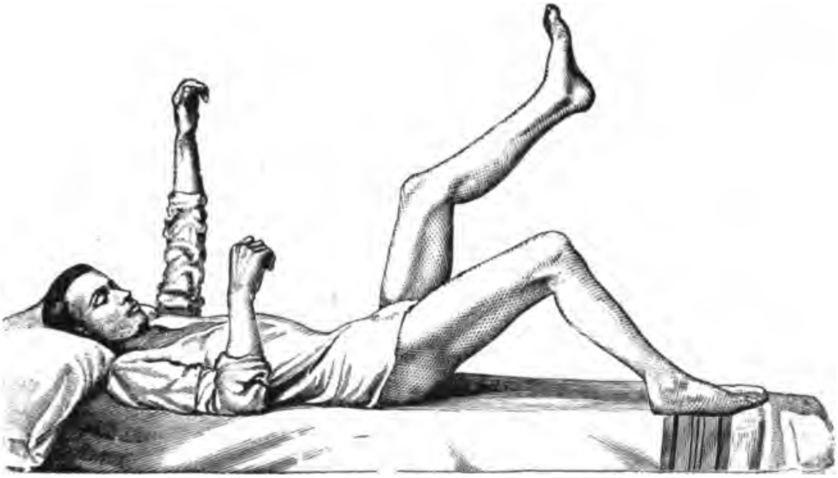

FIG. 74.—CATALEPSY, SHOWING THE ATTITUDE IN WHICH THE LIMBS WILL REMAIN WHEN SO PLACED. (After Hammond.)

nizant of all that happened during the attack, or only retains an imperfect idea of what transpired around her. The patient may understand questions, and yet be unable to respond or move. There is usually complete anæsthesia, not only of the skin, but also of the deeper tissues. The reflexes are usually abolished. The temperature is usually below normal. The paroxysms generally occur without any regularity, and during the intervals the patient is in good health, or presents various symptoms of hysteria. Occasionally it alternates with hysterical attacks. The termination of the paroxysms almost always occurs suddenly; the patient takes deep respirations, sighs, wakes up, yawns, and stretches the limbs.

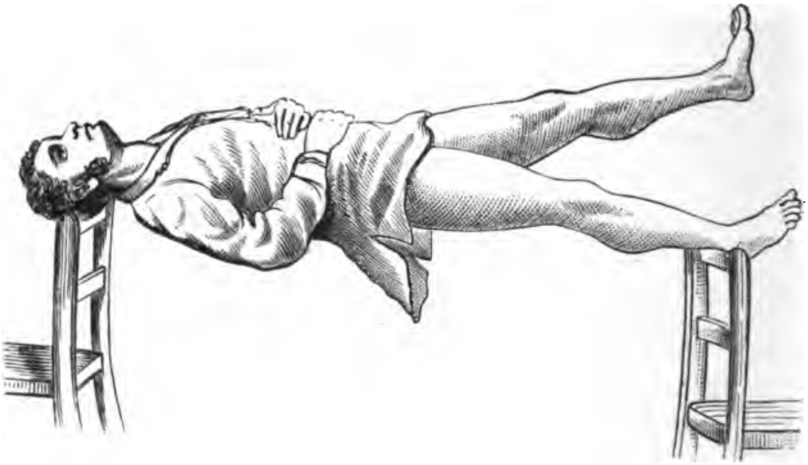

FIG. 75.—CATALEPSY, SHOWING THE DEGREE OF RIGIDITY INTO WHICH THE MUSCLES ARE THROWN WHEN THE PATIENT IS IN A CATALEPTIC FIT.

The pathology is entirely unknown.

The prognosis and treatment are similar to that of hysteria.

Catalepsy may be induced by the method termed "hypnotism." This is done by suggesting to the mind the state of rigidity of the muscles, or by raising the eyelids and placing a dazzling light before the eyes while they are in the "hypnotic" state. If only one eyelid is raised, the cataleptic condition occurs only on the corresponding side.

Trance.

Trance is a peculiar, sleep-like state, from which the patient cannot be roused, or can be roused only imperfectly, and which is not due to any organic disease of the brain or to any poison. This, like the preceding affection, is closely allied to hysteria. The sleep may last a few hours, a few days, or a few weeks, or in rare instances even months. The patients usually rouse long enough to take food, and then relapse into stupor again. In profound trance the mental faculties may be entirely suspended, consciousness entirely lost; but in milder cases, however, the patient may be aware of all that passes, although unable to make even the slightest manifestation of consciousness.

In profound types of trance the patient may, to all appearances, be dead. This state has been termed the "death trance," in which no sign of vitality can be recognized. Gowers has given the following methods by which the presence of life may be ascertained: (1) By the absence of any sign of decomposition; (2) by the normal appearance of the fundus oculi as seen with the ophthalmoscope; (3) by the persistence of the excitability of the muscles to electricity. This actually disappears in three hours after *actual* death.

The prognosis is usually good, although cases are on record that have slept on to a fatal termination.

Treatment is similar to that of hysteria.

Hypochondria.*

This is an affection characterized by a tendency to morbidly exaggerate the various sensations of the body and their importance. It is to the male sex what hysteria is to the female sex. In other words, it is the brother of hysteria. Objections have been brought forward claiming that hypochondria is not to the male what hysteria is to the female; also, that it is a distinct neurosis, and is more closely allied to insanity than hysteria; that the prevailing mental state is that of depression, and that the morbid sensations are not, as a rule, excited by any obvious, external cause, as is most often the case in hysteria. If we but observe the difference in the general make-up of the nervous organizations and temperaments of the two sexes—the impressionable nervous system of the female, as compared with the more phlegmatic male organization—it will be obvious why the symptoms of the former partake more of the nature of a nervous excitation, while the latter takes on a depressant form, resembling in many of its clinical aspects certain forms of insanity, especially melancholia. Neither disease, however, confines its attention to one sex, for it is by no means rare to meet with most characteristic and complete cases of hypochondria in women, just as we occasionally meet with typical cases of hysteria in young men. It is met with chiefly in the middle period of life, although cases are sometimes observed during the later periods of childhood, and more rarely in old age. Heredity is an important factor in many cases of hypochondria, the ancestors, near or remote, being subject to some one or other of the allied neuroses, such as insanity, epilepsy, neuralgia, etc. The most severe forms occur in persons whose family present a tendency to insanity. It often arises from reflex irritation of the viscera, as the liver, the bowels, the bladder, the sexual organs, etc.

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* Hypochondria has been classed by some writers as a form of insanity, but this classification is hardly justifiable. True, many of these cases closely simulate melancholia, and may imperceptibly pass into that affection ; yet, as a rule, the characteristics of hypochondria are so well marked as to place the affection within the boundary lines of sanity.

Any functional disturbance of the nervous system, such as a neuralgia, a nervous dyspepsia, palpitation of the heart, etc., may, by causing concentration of attention upon this spot, serve as the starting point. This then becomes the basis for a fancied malady, and any trifling disorder is magnified into a serious disease. It is also frequently provoked centrally under the direct influence of moral causes, such as reading medical books, quack advertisements, etc. The influence produced upon the mind by reading of diseases or hearing them described is well manifested in many medical students, who imagine that they have one or several symptoms of some disease described to them. Again, this point is well illustrated by Jerome K. Jerome in his novel of "Three Men in a Boat," where he has one of his characters say that he never read a patent medicine advertisement without being impelled to conclude that he had suffered from the particular disease therein dealt with in its virulent form. The diagnosis seemed in every case to correspond exactly with all the sensations that he had ever felt; for example, when reading a patent liver-pill circular, in which were detailed the various symptoms by which a man could tell when his liver was out of order, he had them all. Further on, in consulting a medical dictionary, he was imbued with the belief that he had every disease therein named from A (ague) to Z (zymosis), with the exception of housemaid's knee, for which he felt slighted. He found that in some instances he must have had the disease for months without knowing it, while in others he had it only in a modified form. Finally, coming to zymosis, the last of the diseases, a disease which evidently he had been suffering with from boyhood, he concluded that, as there were no more diseases after zymosis, there was nothing else the matter with him. Now, in a healthy individual, all abnormal ideas or sensations produced by reading descriptions of disease are soon corrected or forgotten, but in a hypochondriac they persist, fostering and essentially strengthening the already existing morbid condition. These persons read all the quack literature on "nervous depression," "indiscretions of youth," "lost manhood," "spermatorrhea," etc., that they can lay their hands on, which always makes them worse.

A French writer (as quoted by the Cincinnati *Lancet-Clinic*), in discussing the subject, says: "How often do we see unfortunate young men, and even old men, whose brains are unstable, or at least subject to exaggerated excitability, who imagine that their semen is dribbling away with their urine, and who confess with sadness that their blood and strength is being sapped away from them; that on pressing their urethra they notice a heavy drop of sticky, viscid fluid, which they imagine is sperm, and this plunges them into the depths of despair and completely demoralizes them. In the United States such cases are innumerable, and such hallucinations are fostered by the public press, that, venal and unscrupulous in the extreme as to money-making by fraudulent advertisements, prints horrible faces of men 'before and after' treatment. To educated medical men, who know how extremely rare are cases of spermatorrhea, the only wonder is that the regular medical profession of that country do not rise up and demand the suppression of such vile newspaper 'ads'—advertisements that send scores of young American men to the asylums and drive many more youths to suicide. No civilized country in the world except America would tolerate such journalism." We agree with the above writer that there ought to be some means of suppressing the pernicious habit of disseminating such literature broadcast; that such abominable suggestions of evil should be scattered broadcast into the families of decent people is a reflection on our jurisprudence.

Hypochondriacs have a great propensity for acting as their own physicians, and keep dosing themselves with patent medicines. The great desire to be cured quickly induces frequent changes in their physicians, and whenever the morbid sensations change their situation and nature, their ideas regarding the seat and nature of the disease also change, and the patient believes himself to be successively attacked with all the diseases whose pathology he knows; or he concludes that he is the subject of a very serious and dangerous disease, or of an entirely new disease that never before existed; or diseases are coined to suit his sensations. Occasionally one meets with a case that is imbued with the belief that from some error, moral or physical, he is so completely injured in health that he is bound to die, and that nothing can save him.

There is a feeling of bodily illness which constantly keeps the attention of the patient concentrated upon himself. This feeling of bodily illness may be vague and general or special and particular. It may be associated with some peripheral nerve-irritation, or may be provoked centrally, either by moral or physical exciting causes. The feeling is increased and aggravated by attention, and may be transferred from one part of the body to another. All sensations are morbidly watched and seriously commented upon and analyzed in the sense of the ruling gloomy and anxious frame of mind. The functions are, from one cause or another, thrown out of gear, so that the automatic action of sensation no longer exists. He feels everything he does, and knows from his sensations that he has viscera. This perversion of the sensations is a constant source of worry and distress to him. He complains of all sorts of sensations. The least pain about the heart makes the unfortunate victim think that he has heart disease. One complains that he is growing weak in the muscles; another that he has suffered as no one has ever suffered before; that it is quite useless to compare his case with anyone else, as it is utterly unlike all others. He applies to his own case all he reads or hears, and is almost constantly occupied with the state of his health. He is constantly examining his tongue, feeling his pulse, and studying his bodily functions.

His disposition becomes changed. He becomes dejected, sorrowful, morose, low spirited, peevish; he is impatient, and everything worries him and he is very easily fatigued. He complains of a sensation of heat, cold, formication; sensations as if the head would burst, as if he were empty, dead, torn in pieces, etc.

The appetite is generally poor, the tongue coated and the breath foul; digestion is accompanied by great development of gas, thereby causing a feeling of oppression or palpitation of the heart; there is usually constipation; sleep is broken and often disturbed by dreams of an anxious type, which give him mental distress. His memory and judgment are good; rarely ever any mental weakness.

The prognosis in the majority of cases is favorable. It is less favorable in those cases due to hereditary influences than in the acquired form. The rapidity with which cure is obtained depends also upon the length of time in which it has been developing, the age of the patient, and the physical basis from which it springs. The older the case and the longer and more steadily it has been developing, the less hope there is for a rapid recovery. The course, however, is in general very slow, and very frequently presents remissions. The only affections with which hypochondria could be confounded are hysteria and melancholia.

In hysteria, the symptoms more usually partake of the nature of a nervous excitation, while in hypochondria they are usually the opposite—a nervous depression. Hypochondria is distinguished from melancholia, to which it is very nearly allied, by the persistence with which the patient assigns his malaise to bodily disease, and by the degree to which his thoughts are enthralled and engrossed by his bodily condition; morbid sensations are most marked in hypochondria, while morbid feelings characterize melancholia.

In the treatment of these cases, all physical causes, as reflex irritation, etc., in so far as they can, must be removed. Electricity will prove a powerful adjunct in the treatment of these cases, especially insulation and the application of the static sparks.

In the therapeutical treatment the following remedies are especially called for:

Nux vom.—Nux is one of the chief remedies in hypochondria, especially where it is brought on by sedentary habits, for example, studious men sitting too much at home; the patient low spirited and ill humored; has an irritable, angry disposition; disinclined to work; great prostration, especially of mornings; headache, especially in the frontal region and temples; appetite poor; tongue covered with a yellow fur at the base; bitter taste in the mouth; bowels costive; constant but ineffectual urging to stool. Especially useful in cases that have been dosing with all kinds of quack medicines.

Alumina.—Very low spirited and inclined to weep; trifling things appear insurmountable; an apprehensive state of mind; fears that he is going to lose his reason, that he will never recover; exceedingly peevish and fretful; sleep unrefreshing; unable to sleep on account of a rapid flow of ideas or fancies; drowsy during the day; there is a great deal of indifference to mental and physical labor; an hour seems to them a half a day.

Anacardium.—Patient very much depressed; clumsy and silly in his behavior; a peculiar headache; sensations as if a plug were in the head; pains located chiefly in the forehead. The gastric symptoms are characteristic, hungry much of the time, better while eating, worse after eating; constipation, with frequent urging to stool, but when an attempt to move the bowels is made the desire passes away.

Conium.—Conium produces a perfect picture of hypochondria; inability to sustain any mental effort; tired, weary sensation in the brain, with physical as well as nervous prostration; discouraged; despondent; everything about him impresses him unpleasantly; sexual desire, with partial or complete incapacity; night emissions; discharge of prostatic fluid when at stool; this causes him to think that he is losing his manhood.

Arsenicum.—Great despondency, thoughts of death; sad and gloomy; excessive anxiety; attacks of anxiety at night, driving him out of bed; wants to go from one bed to another; restless, cannot rest anywhere; sleeplessness, sleep unrefreshing and full of tiresome dreams; if getting awake at night, difficult to fall asleep again; mental confusion; easily worried; great prostration; appetite poor; a sour, bitter taste; violent burning on the tongue.

Natrum mur.—Low-spirited condition of the mind; inclined to be sad, even to weeping; gloomy thoughts; apprehensive; feels as if something were going to happen; wakes up at night with palpitation of heart, and cannot go to sleep again, because bad, unpleasant events occupy his mind; disinclined to mental work, easily confused; mental application aggravates all the symptoms; excessive irritability of the sexual organs; frequent emissions, followed by chilliness and lassitude, with increased sexual desire; constipation, and when the bowels are moved the mind is relieved (characteristic symptom).

Sepia.—Patient decidedly averse to society; indifferent to business affairs, and also to his family; great sadness and dark forebodings about his disease; great irritability from slight causes; hardly tolerates a civil question addressed to him; very nervous, restless, and fidgety; gastric derangements; sour eructations and formations of fetid gas in the abdomen; a feeling of oppression, of discomfort.

Stannum.—Patient feels in the highest degree miserable, and by exaggerating his ailments renders life disagreeable to those around him; he is weak and uneasy, both mentally and physically; he is troubled with gastric pains which compel him to walk about for relief; the face is apt to be pale and shrunken, with dark rings around the eyes; a weak, gone feeling in the stomach; the rectum is inactive, and much urging is required to evacuate even a soft stool.

Staphisagria.—This remedy, according to Berjeau (as quoted by Hart), may be employed when there is hypochondria resulting from masturbation; great taciturnity; constant uneasiness as to the state of one's health; imaginary fears; queer notions that expose the patient to the suspicion of being thought crazy; great deficiency of animal heat, and a tendency to take cold easily; there is giddiness and sleepiness; the eyes are deep sunken, red and lusterless; the hair falls off; annoying toothache and caries of the teeth; teeth very brittle; a dry cough, aggravated frequently after eating; indigestion attended with great flatulence; stools dry and lumpy; urine is of a deep red or yellow color, with brick-dust sediment; continual loss of prostatic fluid; sexual desire impaired.

Zincum.—Very hypersensitive; the least noise, or anyone talking, affects his nerves and makes him morose and impatient; extremely variable mood; alternately fretful, irritable, quarrelsome, despondent, and depressed; pressure on top of head, or a stinging, tearing headache, more after dinner; ravenous hunger, especially about 11 or 12 a. m., with great weakness and trembling of the lower limbs.

Paralysis Agitans.

(*Shaking Palsy, Parkinson's Disease.*)

Paralysis agitans is a chronic, progressive disease, characterized by a coarse form of tremor, and sooner or later accompanied by muscular weakness, rigidity, and a peculiar attitude and gait. This is considered a functional disease, as no anatomical changes can be demonstrated.

Ætiology.—This is a disease confined to middle-aged and old persons, occurring most frequently between forty and sixty years of age; rarely under thirty. It occurs more frequently in men than in women. Heredity seems to have an influence productive of the disease; it may not have been in the immediate parents of the patient, but affecting members of the family in different generations. The exciting causes, in the majority of cases, are fright, injuries, exhaustive diseases, such as dysentery, typhoid or typhus fever, rheumatism, and exposure to cold or damp.

Symptoms.—The onset of the disease is usually slow and gradual, and is usually preceded by prodromal symptoms, such as insomnia, marked irritability, muscular contractions, temporary feeling of weakness, or rheumatoid and neuralgic pains in the limbs. The disease proper usually begins with some aching pains in the arms and slight tremor of the muscles of the hand and fingers, the tremor gradually extending to the arms and legs; the upper extremities are affected more frequently than the lower. As the disease progresses, the muscles of the head and neck become involved, and sometimes the lower jaw, lips, and tongue; the head is in more or less continuous oscillation at first, controlled by the will at least to a certain extent. The expression of the countenance is vacant and fixed; resembling a mask, because there is so little play of the features. Very often the mouth is kept wide open, and the saliva drools continually from the lips, or is swallowed with difficulty. There is always a peculiar redness and flush in the face, seemingly indicative of health, but really due to vaso-motor paresis. The speech is generally slow, monotonous, and indistinct; the voice high-pitched.

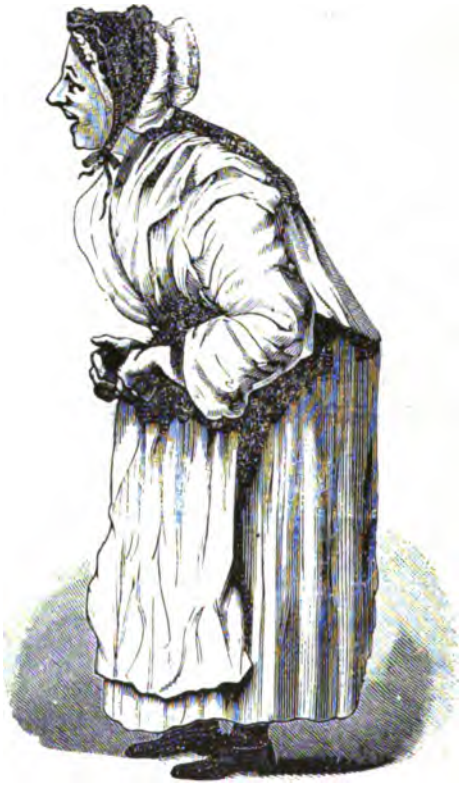

FIG. 76.—PARALYSIS AGITANS, OR SHAKING PALSY. (Charcot.)

The gait in a well-marked case of paralysis agitans is peculiar; the patient holds the head and shoulders stiffly, bending the head and neck slightly forward; the shaking hands are usually held out in front of the body; the step is short and shuffling, with a tendency to trot rather than to walk when once started

—so called *propulsion*, and it is often difficult to stop himself. This bending forward and tendency to run is caused by the effort which the patient makes to maintain his center of gravity within the base. In other cases there is a tendency to go backward—*retropulsion*; in many instances the patient can walk backward better than forward. These patients experience great difficulty in suddenly stopping or in turning around suddenly to the other side.

When the disease becomes fully developed, the hands are apt to assume the so called " bread-crumbling position "—*i. e.*, the thumbs and fingers approximate and moving, usually over one another, as in the act of crumbling bread. (Gray.) But again, in other cases, the fingers may assume an attitude commonly employed in holding the pen. The arms are usually flexed at the elbow-joints, sometimes slightly, sometimes almost at right angles. The fingers may be fixed at the joints; the muscles of the lower extremities may become rigid, often producing deformities, such as talipes equino-varus and distortions of the toes. Sensibility is rarely affected, but the patient may, however, complain of subjective sensations, such as " rheumatic " pains, cramps, and muscular stiffness, especially in the lower extremities; also of a sensation of heat or cold. " The sensation of *heat* may be so great that only the thinnest covering can be endured at night, even in the depth of winter." (Charcot.) From the very first there is usually slight muscular weakness, but there are no evidences of atrophy or atrophic changes in the muscles of the limbs, even in the advanced stages of the disease. The reflexes (knee-jerk, etc.) are usually normal. The mental faculties are not, as a rule, affected until near the end of the malady, and in some instances not at all. There are exceptions, however, to this rule; in some cases there may be loss of memory, mental dullness, peevishness, stupidity, and even dementia.

In the earlier stages of the affection the *tremor* may be momentarily controlled by the will; but it soon becomes uncontrollable, and even persists during sleep. The tremor of paralysis, as pointed out by Parkinson, *continues during rest* (pathognomonic symptom). The tremor is increased by any muscular effort. " If the tremor increases in violence or extent, there may be paralysis developed, but yet it is a curious fact that they may go on for years (ten, fifteen, or twenty) with very little inconvenience and attend to their business." (Ranney.) When the disease is fully developed, the patient may be unable to dress, bathe, or feed himself.

Pathological Anatomy and Pathology.—Of the seat and nature of the lesions in paralysis agitans we are in ignorance. Certain lesions of the brain and cord have been found, such as tumors, hemorrhage into the internal capsule, focal inflammatory disease, and induration of the pons, medulla, and cord; but these must be considered either as accidental concomitants or as the result of long-continued functional disturbances. The theory is that it is a functional disturbance of the motor cells of the cortex of the brain, due to an irregular distribution of nerve-force. This hypothesis is deduced from the facts that the tremor ceases during sleep and that an attack of cerebral hemiplegia at once arrests the spasms on the affected side. Gowers says the persistence of the disturbance of function shows that it must depend upon changes in nutrition in the nerve-elements (probably degenerative), but that these are too fine to be revealed by alterations of structures recognizable by the microscope.

Prognosis.—Favorable as regards life; death rarely ever occurring, unless from exhaustion, bed sores, etc. As regards a cure, it is unfavorable, the disease continuing throughout the entire life of the patient. Recoveries are exceedingly rare, and relapses are very frequent.

Diagnosis.—In a well-developed case the diagnosis is not difficult. The coarse tremor, the peculiar gait, the position of the arms and fingers, and the high-pitched voice are characteristic of this disease only.

Treatment.—The first thing to be done in the treatment of all cases is to remove the exciting causes, if possible, providing they can be ascertained. Electricity has proven of value in a few cases where it has been persistently adhered to. Hammond recommends the employment of the galvanic current to the spinal cord, sympathetic nerve, and the affected muscles. Static electricity has already proved itself to be one of the best agents in the treatment of this stubborn affection, and will undoubtedly present a still better showing when it has been scientifically applied according to modern electro-therapy. "Suspension is of some use in a minority of cases not too much advanced." (Dana.)

In the majority of cases the treatment must be confined to limiting or moderating some of the symptoms, and to do this successfully the case will have to be specially individualized.

Neurasthenia.

(*Nervous Prostration, Nervous Exhaustion, Brain Fag.*)

The term "neurasthenia" is a broad, general one, used as a convenient designation for a group of symptoms of nervous disorders that are not sufficiently different in character to bring the case into some special category, or which have no common or negative characteristics, so that they do not conform to any of the types that have received different names.

Neurasthenia is one of the so-called functional diseases—that is, the pathological alterations are either cellular or vascular in so slight a degree that their exact nature has not yet been determined by the aids to investigation that are at our disposal in our present state of knowledge.

Neurasthenia underlies and represents to a certain degree the starting point of all the more serious nervous disorders and the soil from which they grow, and, if the cause which produces it is not checked, eventually develop hysteroid, epileptoid, or paralytiform symptoms, which may still later develop into these representative diseases; but if it does not continue to develop, the case remains as neurasthenia, and the patient may, after a longer or shorter time, be restored to perfect health; or, in other words, as long as the disease is kept within certain limits it is termed *neurasthenia*, but as soon as it passes certain limits it becomes *actual disease*.

It is not always possible, however, to separate the symptoms in a given case, and say that one set is purely functional and belongs to the class of neurasthenia, or that another set belongs to the commencement of an organic disease.

The term "neurasthenia," as defined by many writers upon this subject, embraces entirely too much; many of them bring under this heading the symptoms belonging to spinal irritation, hypochondria, etc. The older writers (and a few of the later) divided neurasthenia into two divisions—a *cerebral* type and a *spinal* type; but they claim: "The distinction between the cerebral type and the spinal type should not be made in each and every case, because various combinations of symptoms of the two are often encountered in the same individual." The true facts of the case, however, are that there are no such divisions. In a general way, it may be said that the functions of the nervous system are below par, that there is nervous exhaustion, and that there has been a leakage of nerve-force somewhere. We can easily conceive that the *whole* cerebro-spinal nervous system or the *whole* sympathetic nervous system, or both, can become asthenic, but precisely *which part* is affected, to the exclusion of the others, is not possible to ascertain.

Ætiology.—AGE.—Neurasthenia is an affection generally of the adult (middle) period of life, rarely ever beginning before eighteen or after fifty.

SEX.—The male sex furnishes a much larger proportion of cases of neurasthenics than the female sex.

RACE.—It is said that Americans, as a race, suffer from this affection more than any other one in the world.

CLIMATE.—Changes in the weather, especially during the spring months, when the temperature may within a few hours change from a summer heat back to winter temperature; for it is absolutely impossible to accommodate one's self to these varied changes that come so suddenly and without warning;

also, excessive, long-continued, cold, dry weather, causes the system to suffer a loss of nervous force.

Heredity is a very important factor in the primary forms, and the influence of heredity is manifested by the coexistence of other neuroses in the same family. It occurs in rural as well as urban populations. The disease is much more frequent among the better classes of society than among the poor. This point is well brought out by Dr. I. N. Love: "While by no means maintaining that leisure and wealth are the only conditions favorable to neurasthenia, so called, I still urge with Beard that it is seldom found among those who live below the upper crust of the social world; that its habitat is rather in Fifth Avenue than the Five Points. The manual laborers of the world, however little they may know, generally know enough to rest when they are tired, and they have the advantage of fewer superheated and poorly ventilated homes; besides, their muscular development holds down their emotional centers to a safe level. Neither are they, as a rule, disturbed by the trinity of A's which confront a large proportion of those in the higher walks of life—viz., Ambition, Avarice, and Anxiety; nor by the trio of L's which environ the rest—viz., Laziness, Luxury, and Lust."

Neurasthenia is due primarily to a leakage or a waste of nervous vitality, either mental or physical. The strain to which the nervous system is subjected, through the requirements of modern times and the generally increased pace at which we live, has a tendency to excite and exhaust the brain so that men break down prematurely from overwork and want of rest. The wonder is that more people do not suffer from nervous prostration when we take into consideration the high-pressure living and wear and tear of the present day.*

Excessive brain-work, worry from business cares or the anxieties of a family, worry about things that do not exist or over which they have no control, etc., are all prolific causes. Shock, either mental or physical, of sudden joy or sorrow, or from fright, may produce this disease; trauma also is a cause, as evidenced by the many cases of so called "railway spine." It is met with frequently among women approaching the middle period of life and who are exhausted by the strain of maternal duties, rapid child bearing, over-suckling, menorrhagia, or a profuse leucorrhœa. Dietary irregularities, as overeating, or irregular times of eating; faulty habits as regards sleep, exercise, hours for work, and recuperation, if not corrected in time will induce neurasthenia.

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* The following trite, though too true, saying which is applied to us, Americans, illustrates quite forcibly our method of rushing through business and through life: A card on the office door, "Gone to lunch, will return in five minutes." Hence, also, the reason for the saying that the Americans, as a race, suffer from this affection more than any other one in the world.

Reflex irritations are the prime cause of many cases of neurasthenia. The number that have been cured by the removal of reflex causes constitute an army of themselves. Chief among the reflex causes are pathological changes in the dependent outlets of the body. In a great majority of cases you will find, chronic in type, piles, pockets, fissures, papillæ, carunculæ, granulations of the endometrium, one or all acting as exciting causes. Subinvolution and decided mechanical displacements are more potent in causing neurasthenia than the chronic inflammatory states. A cicatrix of a lacerated uterus, prostatic and urethral disorders, unduly contracted rectal sphincters, atrophy or excessive irritation of the mucous membrane of the dependent outlets are all capable of inducing this condition. Prolonged unremitting contraction of any involuntary muscle not only wearies the muscle, but tires the entire sympathetic nerve, thereby undermining the vigor of every peristaltic action in the body and laying the foundation for disordered functions and passive congestions which are the beginning of all pathology. Another source of reflex irritation is in errors of refraction and ocular insufficiency. An overstrained eye-muscle may develop a sympathetic headache that will make life a burden rather than a joy. Stenosis and hypertrophic catarrh of the nasal passages, acting either directly or by disturbing the visual apparatus, may be a cause. Overtaxed genital organs, from excessive excitement of the sexual functions or from masturbation, constitutes a frequent and positive cause of this affection. Still other causes are alcoholism, morphinism, cocainism, and diseases of the kidneys, heart, liver, and stomach.

Symptoms.—Neurasthenia occurs in all possible degrees of intensity, and varies from a condition of perfect health to that of actual disease. The affection sometimes comes on suddenly, but more generally it is of slow development. It may be manifested by a slight impairment of the mental faculties; mental power is lessened; inability to concentrate one's thoughts; memory is poor; unable to read or write say for a very short period, although the power of thought and of judgment is in no way perverted; he is deficient in will-power; he is irritable; little things annoy him, and he is hardly able to control his temper where there is even the slightest provocation to anger; he is depressed and easily discouraged; he loses interest in his work, dreads to assume any responsibility, and has morbid fears regarding his business, general health, and his future. Insomnia is one of the most persistent and troublesome symptoms in this affection. The patient passes sleepless nights and complains of prostration and dullness next morning; sleep is unrefreshing; he may sleep one night fairly well, but the succeeding night is one of wakefulness. This condition goes on increasing until only two or three hours of sleep at different intervals during the night are obtained. Vertigo may accompany the insomnia as a result of the exhaustion, or it may be the only symptom observed for some time preceding the actual manifestation of the disease. "It may be caused by hyperæmia or anæmia of the brain; if by the former, it usually occurs either after eating or at night after the day's work is done; if caused by anæmia, it more likely occurs in the morning and before meals, when the fuel which supplies the nerve-force has been exhausted." (Martin.)

Headache is one of the most constant symptoms of neurasthenia. It may be due to hyperæmia or anæmia of the brain, or it may be reflected from some uterine displacement or stomach irritation. The pains may be located in any part of the head, but most frequently in the occipital region and vertex, except when due to eye-strain, when it is more likely to be in the forehead. Various forms of neuralgias are met with, such as sciatic neuralgia, neuralgia of the arms, facial neuralgia, neuralgia of the heart or angina pectoris. Mastodynia and pleurodynia are very common, the latter manifesting itself by the presence of a spot about the size of one's thumb under the left breast. Neuralgic pains or muscular cramps, cramping pains in the limbs, numbness, tingling sensation of the limbs, and cold hands and feet are annoying symptoms met with quite frequently. Some patients complain of dull, aching pains in the back, sometimes felt throughout the entire length of the spine, at other times only in the sacral region.

A troublesome symptom met with in many of these cases is a buzzing or ringing in the ears; it is usually worse at night, and may prevent the patient from sleeping. In the majority of cases the sexual functions are weakened and irritable, and in men there is impotency as well as loss of sexual desire. In some, however, an hyperæsthetic condition of the sexual organs is present, with increased sexual desire.

Nervousness, next to vertigo, is most frequent of all the symptoms. Palpitation occurs on slight exertion, and there may be pseudo-anginal attacks, sensation of oppression and discomfort over the heart, or a feeling of shortness of breath. Nervous dyspepsia is a frequent symptom met with. Sometimes there is a nervous diarrhea, alternating with constipation.

Hyperæsthesia and muscular weakness are the two chief symptoms of neurasthenia. Paralysis or anæsthesia never occurs in simple neurasthenia.

Diagnosis.—In forming a diagnosis, we must carefully examine the patient and take into consideration the previous history of the disease, The vertigo, the sense of fullness in the head, the tinnitis aurium, the lessening of the mental powers, the inability to concentrate the thoughts, the patient being easily exhausted from the slightest exertion, either mental or physical, together with the fact that there is no paralysis, no anæsthesia, no muscular atrophy, and that the reflexes are normal, point to a case of neurasthenia. Nevertheless, a prolonged observation will often be necessary in order to exclude the onset of other functional diseases.

Prognosis.—Prognosis favorable as regards recovery. Neurasthenia is not of itself a condition that leads to a fatal result, but lesions of the brain and spinal cord develop as a sequel of the neurasthenic state. The majority of cases of neurasthenia tend to a more or less imperfect recovery. In other cases, however, the tendency is to progress and eventually develop into a more serious type of functional disease, unless checked by proper treatment. Death does not occur from neurasthenia *per se;* only from an intermittent disease.

Treatment.—Each case must be made the subject of separate study, for every case is a law strictly unto itself. The possibility of succor for the distressed comes only through regulating the vasomotor power, or, in other words, equalizing the circulation. Ordinarily such cases receive but little credit for their bad feelings. They are denominated "cranky" and unreasonable, and often they are neglected even by their physician, for he is inclined to consider their condition imaginary, and thus looking upon it lightly, he is sure not to investigate the depths of their real condition sufficiently to give them the relief for which they are seeking.

As it is a disease due to nerve-waste, every case should be examined for direct or reflex causes, either mental or physical, for the source of the nerve-waste. The line of treatment would resolve itself into the following heads: 1. Remove every cause, both mental and physical, as far as may be possible. 2. Correct all orificial pathology. 3. A judicious use of electricity, especially of static insulation. 4. Prescribe the indicated remedy.

All causes of depression and exhaustion of the nervous system should be sought for and eradicated. If the cause is mental overwork, the patient should be restricted as far as possible and more *rest* enjoined; in all cases rest from work that is abnormally depressing should be secured, and the rest made more effective by such mental and physical influence as can be secured by change of personal local surroundings.

The great source of nerve-waste in the larger majority of cases of neurasthenia is irritation or disease of the dependent outlets of the body. These are the cases that demand thorough and all-around orificial work. These are the cases that have been sent to the seashore, to the mountains, and to the health resorts with the hope that Nature would do something for them, but the benefits which they derive from these is only temporary, for no sooner does the patient resume his former vocation than he complains of " that tired feeling," sleeplessness supervenes, and all his old troubles return. These are the cases that require flushing of the capillaries, so that the obstruction may be washed away and every nerve and organ of the whole system bear its proportion of labor.

Electricity.—Tenderness of the spine and various pains in the back and limbs are, as a rule, relieved or dispelled by one or another of the different forms of electricity. Regarding the choice of electricity, it is impossible to lay down rules that shall govern us in all cases; sometimes all three forms—galvanism, faradism, and the static current—act equally well. In using galvanism one electrode may be applied to the nape of the neck, the other over the lumbo-sacral region, thus including the entire spinal cord. Either the labile or stabile method may be used. If the brain is to be galvanized, an electrode should be placed at the nape of the neck and the other passed over the brow. Mild faradization is sometimes found useful in these cases. Many cases are benefited by general faradization. Rumpf advocates the brushing of large surfaces with the faradic brush. In the greater majority of cases static electricity will prove the most beneficial. It may be given in the form of insulation alone; or insulation followed by the breeze to the head, or by sparks to the spine. In using static insulation each case will have to be individualized. If the case is in an anæmic and prostrated condition, positive insulation is required; but if there is a high degree of nervous excitability, which requires something to quiet it, negative insulation should be employed. Reversing the polarity in these two cases would cause an aggravation of their ills instead of relieving them. The static breeze, applied to the head, will sometimes relieve depression and headache like magic. Severe peripheral pains and the different neuralgias are, in the majority of cases, relieved by the sparks. Galvanization of the spine, combined with static insulation and sparks, will prove more successful than any other method of treatment.

The therapeutic treatment can only be found by giving that remedy which possesses the physical and diagnostic symptoms of the case and which corresponds also to the special distinguishing and peculiar symptoms which mark the individual case. But, to assist in making a choice, a few of the remedies that are called for most frequently are given.

Actea racemosa.—Great melancholy with sleeplessness; a miserable dejected feeling; nervous, irritable; vertigo, dizziness with impaired vision; dizziness on rising in the morning; wavy sensation in the brain; dull, frontal headache relieved by pressure; dull pain in the occiput with shooting down the back of the neck; sensation as if the vertex opened or a sensation as if the top of the head would fly off; severe pain in the back, down the thighs, and through the hips, with heavy, pressing, chilliness down the back from 11 to 12 m., with pain under left shoulder; feet and hands cold, then hot; dull, heavy aching in small of the back; trembling of the legs, scarcely able to walk. Especially indicated in the nervous exhaustion of women due to overlactation and uterine disease.

Argentum nit.—Dullness of head; mental confusion; unable to fix his thoughts on his business; headache, increased by mental labor; gets dark before the eyes when attempting mental work; pressing pain in the whole head, from mental exertion; better from firm pressure; loss of will power; vertigo when walking on the street; violent palpitation from the slightest mental emotion, or from sudden muscular exertion; backache, worse when first rising from a seat and better from moving about; small of the back feels weary; pains in the back and lower limbs of a crampy character; trembling, weakness of the lower limbs accompanied by drowsiness and chilliness.

Aurum.—Loss of memory; forgetfulness; ideas become confused; rush of blood to the head, with violent palpitation; great anxiety; dull frontal headache; a feeling of fullness in the head, accompanied by roaring in the ears; heat of head with cold hands and feet; headache from the least mental exertion; vertigo when stooping, as if turning in a circle; sparks or flashes of light before the eyes; sad, as though a great misfortune impended; despondent, weary of life, peevish; irritable without cause. Great prostration after the slightest mental or physical exertion is the keynote for aurum.

Calcarea phos.—Forgetfulness, forgets what he has done a short time ago; difficulty in performing intellectual work; feeling of fullness and confusion of the head accompanied by headache; fullness and pressure of head; headache on vertex and behind the ears, with a drawing in the muscles of the neck; burning on top of the head; scalp sore and tender; neuralgia especially of the upper jaw-bone, extending from right to left; face pale, sallow, and covered with cold sweat; body cold; profuse night sweats; pain in the back, especially between the shoulder blades; tired, weak, lame feeling of the lower limbs; they "fall asleep" easily; cramp-like pains in the feet, especially in the ankle joints.

Ignatia.—Mental effort is irksome; anxiety; sleeplessness; despair; sensitive, peevish, and excitable; weight at the back of the head; tendency of the head to incline backward against back of chair; nervous headache coming on at the same hour and day weekly; pale, sunken face, or alternate redness and paleness; feeling of weakness in the epigastrium, with great depression; great distention of the abdomen, "so full she could hardly breathe"; loss of appetite; constipation; cold hands and feet up to the knees; numbness of the feet and legs.

Nux vom.—Defective memory; loses the connection of ideas; everything goes wrong; loss of energy; disinclined to work; great lassitude and weakness; gets angry or excited easily; irritable, quarrelsome even to violence; every harmless word affects him; over-sensitiveness to external impressions; such as noise, smell, light, and music; the most trifling ailments are unbearable; he is anxious and beside himself; vertigo on rising; headache of men accustomed to great mental exertion; pressure in the frontal region and temple; worse on stooping, when it seems as if a piece of the forehead would fall out; headache in the morning, as if he had not slept; head feels as if it would split open; scalp sore to the touch; awakens at 4 a. m., with mental anguish; tongue heavily coated white, yellow, or brown; appetite poor, bloating coming on two to three hours after eating; aching, drawing, or bruised pains in the limbs.

Phosphoric acid.—Cerebro-spinal exhaustion from overwork. The least attempt to study causes heaviness, not only in the head, but in the limbs; numbness, vertigo; occipital headache and pain in nape of the neck from exhausted nerve power; confusion of thought; listless, apathetic; remarkable indifference to everything in life; inclined to be drowsy and sleepy; the characteristic of this sleepiness is that he is easily awakened from it and is wide awake; tingling and formication, especially in small of back; back and legs weak, yet no pain, except a subjective sense of burning in the spine or in the limbs; ailments from care, grief, chagrin, particularly associated with drowsiness; night sweats toward morning. General debility with feeling of weakness and prostration.

Picric acid.—One of our best remedies in the so called "brain fag" of business men, literary people, and school teachers; slightest excitement or mental exertion, or any overwork brings on headache; headache completely incapacitating them for work; begins in morning on awakening, increases as the day advances; always relieved by sleep at night; chiefly affects the forehead, extending gradually to the vertex; but may begin in the occiput and then extend down the spine; tired feeling on least exertion; tired all over the body; with heaviness and excessive languor; no desire to talk or do anything; indifferent to everything; is obliged to lie down; burning along the spine, and very great weakness of the legs; tired, aching feeling in the lumbar region; the legs are heavy and weak; seems difficult to move the limbs; great muscular debility; inclined to be sleepy during the day; appetite poor; general sense of torpidity.

Zincum.—Nervous exhaustion; backache worse at the last dorsal vertebra, worse while sitting; burning along the spine; numbness, tingling sensation in the calves; weak limbs, weak back, with goneness when hungry; especially at 11 a. m.; weakness, numbness, and tremor of the hands when writing; fidgety feet; must move them constantly.

Insomnia.

Insomnia is not a disease, but merely a symptom, and is a term given to a condition in which persons suffer from partial or complete loss of sleep. Partial insomnia is where the patient is able to obtain only a portion of the usual allowance of sleep; he lies awake one or more hours before he can get to sleep, or he is easily aroused and is unable to fall asleep again; or the sleep is broken, restless, and unrefreshing. Complete insomnia is where the patient goes for several successive nights without being able to obtain any sleep whatever.

According to Dana, the length of time a person can live without any sleep is about the same as that during which he can go without food—namely, three weeks.

Ofttimes patients claim that they have not slept for weeks, but a careful examination will show that there has at least been a drowsy, somnolent condition, which is, in a measure, physiologically equivalent to sleep. Complete insomnia, unchecked, means that the insane asylum is not far away.

Normal sleep varies much in accordance with age, sex, occupation, individual temperament, climate, and habit. The infant requires from fourteen to sixteen hours out of the twenty-four, the adult about eight, yet there are many instances where five or six hours sleep is all that an adult requires. Men require less sleep than women. Brain-workers sleep less than those engaged in manual labor; some of the most brilliant thinkers sleep but little. People of sanguine temperament sleep well, but during middle life may be subject to circulatory derangements which often lead to insomnia. Those of nervous temperament, whose brain and nervous system rule the entire body, sleep little; this class of individuals are hard workers and fatigue their nervous system till conditions occur that lead to insomnia. Persons of lymphatic temperament sleep well, though lightly. Sleep is sounder and longer in cold climates; less sleep is required in summer than in winter. Habit has much to do with the amount of sleep required. People who eat heartily demand more sleep than those who eat little.

Ætiology.—Insomnia may be caused by fatigue of the body or mind. Whatever increases the activity of the cerebral circulation tends to wakefulness. Worry, anxiety, grief, or mental overwork will develop it, keep it up, and finally lead to organic changes in the brain or its blood-vessels. Any cause that produces a debilitated condition of the sympathetic nervous system, thereby giving rise to vasomotor paresis, will produce it.

In anæmia and chlorosis there is often insomnia at night, combined with somnolence during the daytime. Disease of the heart and arteries, and especially disease of the kidneys, may induce insomnia. The secondary stage of syphilis may be accompanied by insomnia. It occurs sometimes as an hereditary neurosis. Odors may prevent sleep. Physical discomfort, as from heat or cold, hunger or thirst, may induce sleeplessness. Tape-worm may act as a cause of insomnia. Constipation and chronic impaction of the bowels may act as a cause. Constipated habits produce wakefulness by the absorption of an alkaloid from the decomposing fæces which prevents sleep. A careful study of the sympathetic nervous system will explain many remote causes.

Treatment.—Insomnia being merely a symptom, whatever the abnormal condition which induces it must be removed. A failure to heed this point will often result in a failure to cure the insomnia, notwithstanding the fact that the greatest care in selecting the indicated remedy has been employed.

Change of climate is often helpful, because the local climatic difficulty is arrested. Some people are helped by going to a high altitude, while others are obliged to seek the lower country. (Dr. J. M. Kershaw.) The physical condition of the subject will determine the kind of climate likely to suit his individual case. Daily exercise in the open air should be insisted on in most cases.

Massage is one of the best adjuncts known, affecting nutrition by increasing absorption of waste-products and equalizing blood-pressure by stimulating the peripheral circulation.

Mental preoccupation, pleasant as well as unpleasant, is inimical to sleep; hence monotonous, dry reading, or grave, heavy, muffled, uncertain sounds, as of distant machinery or vehicles, are often soporific, whereas high, short notes tend to the opposite effect.

The diet should be regulated. Stimulants, tobacco, coffee, and tea should be abstained from by most sleepless people. Regular habits of eating and sleeping, as well as regular attention to the bowels, should be encouraged. A cup of hot water at bedtime will often prove beneficial. A light repast at bedtime, such as a bowl of hot broth, a cup of beef-tea, a glass of hot milk, or a biscuit and a glass of wine, will often work like magic; this is especially the case on cold winter nights, when the stomach craves warmth as much as any other part of the body.

A good flushing of the bowels with warm water, inducing a free evacuation, will give many a patient a good night's sleep. It should be given while the patient is in the knee-elbow position, using from two to four quarts. Rectal injections are particularly serviceable where there is hepatic torpor or a functional inactivity of the intestines.

Hot hip-baths are an important part of the treatment in some cases where the insomnia originates from pelvic disease. They are helpful, whether the subject be male or female. A hot bath of the entire body at bedtime, even in the hottest weather, will relieve insomnia more than any other single measure. A hot foot-bath is an adjuvant too often neglected. Frequent sponging of the head and spine with hot water will prove a useful measure in many cases. When the patient is not too feeble, the cold spinal douche is very effective and is a powerful stimulant to the medulla oblongata. A cold, salt-water compress or abdominal bandage, covered with flannel to protect the clothing, will quiet many nervous women with pelvic troubles.

The application of orificial measures will relieve quickly and permanently many cases of insomnia that have defied all other lines of treatment; thorough dilatation, by flushing the capillaries, equalizes the circulation at once.

Electricity is beneficial in many cases. The galvanic, the faradic, and the static currents have each proved successful, and no general rule can be given for selection. That form of electricity best adapted to the disease which gives rise to the insomnia should be given the first trial; frequently an application to the diseased organ will be followed by sleep.

When the galvanic current is used, place the negative pole over the solar plexus (pit of the stomach) and the positive to the top of the head (avoiding the forehead), and pass down the neck on each side as in central galvanization. MacFarlane recommends very weak and prolonged currents—an application of twenty minutes or upward—on alternate days. He first employs longitudinal galvanization, with the positive pole on the head; then subaural galvanization, the positive pole under the jaw; afterward stronger currents, the positive pole on the cervical vertebræ, the negative pole over the epigastrium; lastly, the positive pole on the cervical vertebræ, the negative pole in a foot-bath tub.

Stevenson and Jones recommend general faradization, or the faradic bath, as the best method of application for the relief of insomnia. Personally I have obtained the best results from static insulation for ten minutes, followed by the spray or head breeze for five or six minutes.

Aconite.—Anxiety with great restlessness and tossing about; sleeplessness due to mental excitement, especially when there is active cerebral hyperæmia, with intense anxiety and fear of death or disaster.

Belladonna.—Sleepy, but cannot sleep, anxious, restless, full of dreams; insomnia from over mental work. Belladonna has few superiors as a remedy for insomnia due to cerebral hyperæmia. The higher potencies seem to act best.

Coffea.—Insomnia from overexcitement of mind, ideas crowd so fast as to prevent sleep; cannot sleep from thinking; wide awake, not the slightest inclination to sleep. Especially useful for teething children, and insomnia the result of great mental strain, joy, night watching, and after acute diseases.

Chamomilla.—Scarcely sleeps, and on falling asleep is tormented by vivid, fanciful, anxious, and frightful dreams; if he sits down during the day he wishes to sleep, but if he lies down he is unable to sleep, and remains wide awake; extreme irritability; thirsty, with hot sweat of head and scalp. Chamomilla acts especially on the vasomotor nerves, and also on the emotional nerve-centers.

Hyoscyamus.—Sleepless from nervous excitement; wild, staring eyes; sleeplessness or dozing, with brain full of ideas, figures, and bewildering images. This remedy is especially indicated after a long illness where the insomnia is due to the starvation of the brain cells.

Nux vom.—The patient lies awake the better part of the night, falls into a dull, heavy slumber toward morning, which does not refresh but leaves the patient more tired than on going to bed. Sleeplessness from overwork, both mental and physical; too close study, especially at night; eyes dull; twitching of the muscles; cannot keep from falling asleep in the evening while sitting. Nux is especially useful for insomnia after mental strain, abuse of coffee; wine, liquors, and in cases due to morphinism.

Stramonium.—Sleepless from intense nervous excitement; restless sleep, full of dreams. This remedy is best suited to cases attended with unusual mental disturbance, or where there is a tendency to maniacal excitement.

Sulphur.—Sleeplessness from nervous excitement, cutaneous irritations, and external heat. Sulphur will often relieve when the patient is drowsy all day, sleepless at night.

Mercury is to be thought of when there is a history of syphilis; the patient is drowsy all day and sleepless at night.

Hypnotics, such as chloral, sulphonal, chloralamid, and paraldehyde, should not be given, for they will only give temporary relief and their continued administration will aggravate the case; also it is a grave mistake to give such stupefying drugs as morphine or the bromides in such cases. Often, where sleeplessness is due to bodily overexertion, the administration of ten or fifteen drops of *arnica* or gelsemium will induce a quiet restful sleep. When sleeplessness is caused by the continued use of tea, *monobromide of camphor* given for a few nights will relieve, after the beverage has been stopped. Thirty to sixty drops of *passiflora,* given an hour before retiring and repeated in one or two hours if necessary, will often induce a natural sleep. One of the best drugs to induce sleep, and one that will not be followed by any bad after-effects, is *cannabis Indica.* Of the action of this remedy Dr. Bessey says: " It acts as a soporific in producing sleep, as an anodyne in removing irritation, and as an antispasmodic in allaying cough and spasmodic breathing in asthma. It acts as a nervine, and produces tranquil sleep without causing constipation as opium does, and there is no headache or stupor; in fact, a little experience with it will show that it will relieve insomnia, nervousness, restlessness, neuralgia, hysteria, and spasms without interfering with any of the functions of the body, and does not leave behind it any of the bad effects of opium or morphine. Five to fifteen drops of the tincture in water, or one-half grain of the solid extract every six hours, or on retiring to rest, will usually suffice, and there is no nausea or indigestion produced by it."

This is an invaluable remedy in obstinate and intractable forms of insomnia. I have had the best results from its use by giving it two or three nights in succession and then omitting it two or three nights. Most generally I give only five drops, and that about one-half hour before retiring.

Exophthalmic Goiter.

(*Graves' Disease, Basedow's Disease.*)

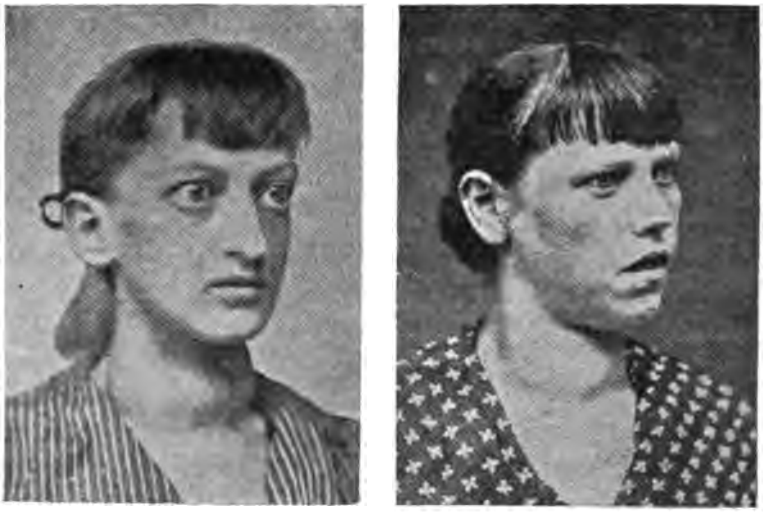
Exophthalmic goiter is a chronic neurosis characterized by prominence of the eyeballs, enlargement of the thyroid gland, and an irregular and rapid heart beat.

Ætiology.—It occurs more frequently in females than in males. It is a disease that may occur at any period of life, from childhood to old age, but occurs more frequently between the ages of twenty and forty. Anæmia and general debility may act as predisposing causes. It cannot be considered an hereditary affection in the strict sense of the term, although cases have been met where the parents or grandparents were afflicted. A neuropathic tendency does undoubtedly have an influence upon its production. The most frequent exciting causes are the emotional (chief of which is fright) and overexertion. Rare causes are exhaustive hemorrhages; amenorrhœa; organic heart disease; blows upon the head; alcoholic excesses; rheumatism, and infectious diseases, such as measles, scarlet fever, and pneumonia. It occurs also in connection with any condition which tends to impair the quantity or quality of the blood.

Symptoms.—The onset of the disease is usually slow and gradual. The three cardinal symptoms—the *prominence of the eyes*, the *enlargement of the thyroid*, and the *increased frequency of the heart*—seldom make their appearance simultaneously. The disease may commence with either one of these three symptoms, but, as a rule, the cardiac disturbance leads the way. The pulse varies from 120 to 160 and even 200 beats per minute; at the same time it is irregular. The least excitement, mentally or physically, will cause an increase in the pulse from 20 to 80 beats. With the increase in frequency there is generally an augmentation of the force of the heart. The patient feels its pulsation against the wall of the chest, and at times the whole body is shaken by the force of the beats.

In the early stages physical examination is negative, but sooner or later the area of cardiac dullness is increased, indicating dilatation of the heart. In the majority of cases, according to Gowers, there is a distinct systolic murmur heard over the whole heart, loudest near the sternum or at the base, but also audible at the apex, and sometimes outside the apex.

As the disease advances, the attacks of palpitation increase, and are often accompanied by dyspnœa. The carotids are dilated, and the pulsation is quite marked in them; the jugulars are also considerably dilated. Enlargement of the thyroid gland soon follows the excessive action of the heart. Both lobes may become enlarged simultaneously; or one lobe may enlarge faster than the other, or it may be confined to one lobe and the isthmus, or to one lobe alone. If only part of the gland is involved, it is oftenest the right lobe; the enlargement is painless, and not usually very great. When the hand is laid on the gland, the arteries can be felt strongly pulsating, and also a peculiar thrill is felt. When the ear is applied to the part, a bellowing murmur can be heard. At an advanced period of the disease these signs subside, and the gland becomes more solid. The next symptom to make its appearance is the bulging of the eyes, or exophthalmos; rarely this may be the first symptom. Usually this is bilateral and symmetrical; occasionally, however, one eyeball protrudes more than the other, usually the right. The exophthalmos varies much in degree. It may be so slight as to cause only a staring appearance, or it may be so great that the insertions of the recti muscles are exposed and the lids cannot be closed. In those cases where the lid cannot be closed, the conjunctivæ being exposed to the air and dust, corneal inflammation may result; also opacity of the cornea, and even sloughing. The pupils are normal and the vision is not impaired. The relative appearance of these three cardinal symptoms is variable. In some cases the goiter is absent; in others the prominence of the eyes is absent; in still others both these phenomena are wanting; but the cardiac disturbance is almost always present.



Figs. 77 and 78.—Exophthalmic Goiter with and without Exophthalmos. (After Dana.)

The protrusion of the eyeballs is often combined with a peculiar symptom that Von Graefe particularly observed—a hindrance to the descent of the upper lid on looking down; that is, the upper lid will not follow the movements of the eyeball; in other words, there is a want of agreement between the movements of the eyeballs and the lids. Another symptom of importance is a peculiar tremor of the limbs. This tremor, as Charcot points out, affects the whole hand, but not the individual fingers. "This tremor is less marked in the lower limbs, and not present in the face or tongue." (Dana.) The electrical resistance of the body is greatly lessened. The reflexes are exaggerated. Other symptoms that may occur in the course of the affection are: Headache, a sense of throbbing in the head; pulsating noises in the ears; insomnia; vertigo; mental depression or irritability; a sense of heat without actual fever; profuse sweating; a troublesome diarrhea; glycosuria; abnormal pigmentation of the skin; local œdema in the limbs; atrophy of the mammæ.

Mental derangements may occur in the course of the affection, such as melancholia, mania, or general paralysis. Mania, however, is the most common condition, and may be the cause of death.

Pathological Anatomy.—In the heart, dilatation and hypertrophy are found in a slight degree, and even mild endocarditis or valvular lesions are occasionally met with. The arteries are found dilated, and may appear to be distinctly hypertrophied. The veins also may be enlarged. "In the thyroid gland the vessels are enlarged, and the connective tissue is increased in quantity, with occasional cystic or colloid degeneration." (Gray.) In the orbit, the most frequent change is an increase in the amount of fat, sometimes considerable, although occasionally normal; and upon rare occasions there is found dilatation of the orbital veins, atheroma of the ophthalmic artery, and fatty degeneration of the ocular muscles. Pathological changes have been met with in the central nervous system (brain, cord, etc.), but these, when present, are rather to be considered as of secondary origin, or else are accidental concomitants.

Pathology.*—Very little is definitely known of the pathology of this disease, but all the evidence indicates that it is due to a morbid state or condition of the sympathetic centers located in the medulla. (The chief controlling centers for the whole sympathetic system being located in the medulla.) Gowers suggests that in all probability the real cause of the derangement will have to be sought for beyond the sympathetic in the central nervous system, as all sympathetic functions are under central control. The dilatation of the heart is due to its rapid action, the systole being so short the blood is not all forced out, and consequently resulting in dilatation. Enlargement of the thyroid gland is due to the dilatation of the vessels—the result of a vasomotor paresis.

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* PATHOLOGY OF GRAVES' DISEASE.—In the Bradshaw lecture Professor Greenfield spoke of Graves' disease or Basedow's disease as if it were possibly a primary disease of the thyroid. He marshaled the facts bearing upon the question of the thyroid origin under the following heads: (1) The examination of the thyroid, of which, so far as he has been able to obtain material, reveals in nearly all cases a peculiar form of proliferation of the gland tissue, unlike that seen in other goiters and resembling a proliferation for the performance of increased function. The earliest alteration in the character of the epithelium lining the spaces is from a cubical to a columnar type. This change is associated with increased proliferation and active secretion. As a sequel, we may find catarrh. The proliferation change is liable to be followed by

But the most difficult problem to solve is the cause for the prominence of the eyeballs; undoubtedly several factors contribute toward this, chief of which is paralysis of the orbital vessels and their consequent dilatation. In some cases there is found an increased deposit of orbital fat; in other cases, however, it is absent. Irritation and consequently contraction of the unstriated muscular fibers of Müller, which run from the eyelid to the membraneous lining of orbit, have a slight influence in causing a protrusion. But there are cases where it is difficult to conceive how even their combined influence can produce the extreme prominence sometimes seen. The rapid

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fibrous overgrowth. The second change is the production of an enormous number of newly formed tubular spaces. The absence of increased vascularity—in fact, the apparent diminution in the vessels—is a point of great practical importance. (2) The relief afforded by removal, partial or entire, of the glands. The removal of one lobe, or even of the isthmus, has sufficed to arrest and cure the disease. (3) The presence in the nervous system of changes, slight in degree, but widespread, especially affecting those centers or nerves which we should suspect from the symptoms to be involved. The fact that these alterations are of a like nature to those seen in toxic diseases—for example, hydrophobia and tetanus—suggests that they also may be of toxic origin. (4) The contrast in many of the leading conditions of myxœdema and Graves' disease, these including both symptoms and anatomical changes. (5) The correspondence in some important respects of the phenomena of Graves' disease with those produced by artificial induction of thyroid secretions. He remarked that we cannot now doubt that all the more important functions of the thyroid are due to a secretion, which can be separated, though not in a pure state. It seems probable that the organs of its excretion are the skin, mucous membranes, and possibly the kidneys.—*Lancet*, vol. ii. p. 1493, 1893.

heartbeat is probably due to impairment of the inhibitory fibers of the spinal accessory.

Diagnosis.—When the three cardinal symptoms are fully developed, the diagnosis is very easy, but in the earlier stages or when one or two of the cardinal symptoms are absent then often it is extremely difficult. In distinction from ordinary goiter, there are the absence of the eye and heart symptoms; also, no murmur is heard over the enlarged thyroid gland, whereas in exophthalmic goiter the murmur is continuous and is of the greatest diagnostic importance. In a case where there is a persistent rapid pulse, 120 or more, even though the thyroid and the eye symptoms are absent, this should lead one in doubtful cases to suspect the beginning of exophthalmic goiter.

Prognosis.—A certain amount of improvement is obtained in the majority of cases. Relapses, however, are frequent. Recovery is possible in recent cases and in young subjects. Remissive intervals sometimes occur. In many cases no improvement whatever can be obtained. Death rarely ever occurs from the disease alone; when it does, it is usually the result of the cardiac affection and of increasing general weakness. It usually runs a chronic course of from three to ten years.

Treatment.—Rest, if the disease is acute. Often the pulse can be reduced 20 to 40 beats a minute by keeping perfectly quiet. The life of the patient must be carefully regulated as regards his diet and his work. Stimulants of all kinds, especially strong tea and coffee, should be prohibited. Excitement and overexertion must be avoided. Electricity has proved of more service than any other measure; in fact, it is about the only agent that seems to have any effect upon this obstinate affection. Eichhorst gives the following directions for its use: The cathode should be applied high up on the neck, and the anode between the scapulæ. The current, from five to ten elements, should be allowed to pass between these points for two minutes. Then, with the anode still upon the cervical spine, the cathode should be placed over the sympathetic and the pneumogastric, upon each side for two minutes. It should first be placed in the auriculo-maxillary fossa, and gradually drawn down along the inner edge of the sterno-cleido-mastoid to the clavicle. Erb has tried the application of a very mild current to the eyes; one pole was placed on the closed eye, and the other on the back of the neck, and later the poles were placed upon the temple. Transverse currents have been passed through the goiter for a direct effect upon it; also, puncture by electrolytic needles has been tried, but with varied success. Electrical treatments should be applied daily for two or three months.

Headache.

(*Cephalalgia.*)

When we consider the subject of " Headache," we are dealing with an affection that is considered among the minor ailments, but which in the aggregate causes more suffering than all other affections combined. Headache is not a disease of itself, but merely symptomatic of disease, or a disordered condition of some organ or organs, or of the system in general.

Headache is of every degree, and may have almost any seat or character. It may be confined to one small spot, in which case it is sometimes called clavus, as if it might proceed from a nail driven into the head; it may occupy a particular region of the cranium, as the frontal immediately over one or both eyes, the temporal, the parietal, or the occipital; it may embrace one side of the head, as in hemicrania, or it may be diffused and of indefinite extent, or the pain may seem to pass through the head from the back to the front, or *vice versa*. The most common form of headache is the frontal, next the fronto-occipital or diffuse, next the vertical, and then the occipital. The nerves of the dura mater are those most involved. Headaches, when occipital, involve the sensory fibers of the vagus and the upper four cervical nerves.

Some persons have headache only when constipated or bilious, or when they have an attack of indigestion. Others suffer from a little pain nearly all the time, exacerbations occurring at various periods. (Dana.)

Headaches may continue for a day or may last for weeks, months, and even years. Women suffer from it more than men in a proportion of about three to one. It is more frequent in city population and among the wealthier classes. Headaches are more common in the spring and fall and in temperate climates.

The varieties of headache which we are about to consider, with the exception of the last division—migraine, which is considered an idiopathic affection—are only such as constitute mere symptoms in the symptomatic series of such diseases as catarrh, rheumatism, gastric derangement, nervous irritation, disturbance in the circulation, etc. Those varieties of headache due to organic cerebral affections, have been considered under meningitis, hemorrhage, tumors, etc., of the brain.

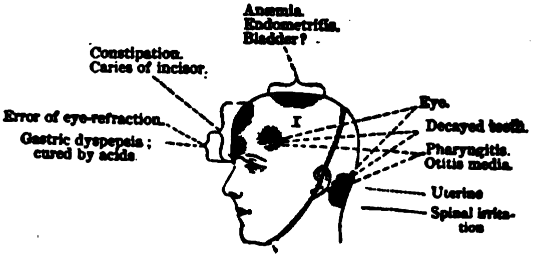

FIG. 79.—SHOWING THE LOCATION OF THE PAIN IN HEADACHES FROM DIFFERENT CAUSES. (After Dana.)

Headache is a disorder of the utmost frequency, and yet there is none which taxes more the experience and scientific knowledge of the physician in selecting the appropriate remedy, nor is any other disease more amenable to treatment when the indicated remedy has been found.

As has been stated, headache of itself is only a symptom, and in studying this symptom we must note its *location, sensation, amelioration*, or *aggravation*, and, finally, the accompanying ailments or complications. It is important to note the time at which the pain comes on, its relation to food, to mental work, and to other influences that may possibly be concerned in its causation.

The following classification of the varieties of headache is based upon the exciting causes which produce them:*

1. Anæmic headache.
2. Hyperæmic or congestive headache.
3. Nervous headache.
4. Neuralgic headache, sometimes called sick headache.
5. Reflex or sympathetic headache.
6. Gastric or bilious headache, also known as sick headache.
7. Rheumatic headache.
8. Catarrhal headache.
9. Toxic headache.
10. Arthritic or gouty headache.
11. Syphilitic headache.
12. Migraine, hemicrania, or true sick headache.

Anæmic Headache.—This variety of headache may be due either to an insufficient quantity of blood circulating through the brain, the result of a weak action of the heart, functional or organic in origin, or to the quality of the blood, the quantity being normal in proportion, but the number of red corpuscles being reduced below the normal proportion, as in anæmia and cachexia. Whenever the red corpuscles, with their constant supply of oxygen (oxygen being absolutely necessary for the evolution of nerve-force in all its forms—Day) are not passing through the brain in sufficient number, the activity of the nerve-element is impaired, the nervous tone of the brain-center is lowered, the mental faculties are clouded and depressed, and there are indications of a general functional derangement of the brain-cells.

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* Headaches may be classed in accordance with their *location* and the *character* of the pain. Dana makes the following classifications: 1. As to location: (*a*) Frontal headaches; (*b*) occipital headaches; (*c*) parietal and temporal headaches; (*d*) vertical headaches; (*e*) diffuse headaches and various combinations of the above. 2. As to the character or kind of pain: (*a*) Pulsating, throbbing headache; (*b*) dull, heavy headache; (*c*) constrictive, squeezing, pressing headache; (*d*) hot, burning, sore sensations; (*e*) sharp, boring pains.

It is of very little significance, however, to the practitioner of medicine, how a case is classified, so long as the classification sheds new clinical light on its nature and causation.

The pain of an anæmic headache is usually located in the vertex, but may also affect the forehead and temples; rarely the occiput. The pain is usually of a dull, gnawing character, or of a burning sensation. Sometimes the pain is peculiarly intense at the back of the eyes, with a sensation as if the eyes were being dragged back into the head. The headache is increased by the erect posture and relieved by lying down. There is loss of memory, petulance, irritability of manner, and indifference to all those subjects which ordinarily possess interest; the patient is restless, unreasonable, and fidgety; there is dizziness and ringing in the ears, and flashes of light before the eyes; the pupils are usually dilated; there is pallor of the face, palpitation of the heart, and coldness of the extremities; the patient lies exhausted on his bed, with slow and feeble respiration, pulse weak, labored and slow, or small, weak, and rapid; appetite poor, tongue furred, bowels constipated. The anæmic headache is worse after a night's sleep, and is relieved by exercise, coffee, or anything that determines more blood to the brain.

Hyperæmic or Congestive Headache.—This variety of headache may be due to an active (arterial) or a passive (venous) hyperæmia of the brain.

In the active variety there is an increase in the amount of arterial blood sent to the brain by an overaction of the heart, or from prolonged thought or severe mental labor, thereby causing a dilatation of the cerebral vessels, and there is a corresponding pressure upon the substance of the brain.

The symptoms will vary somewhat; at times sensation being most affected, at others the mental faculties. The thoughts are rapid, loose, and unconnected, and the ideas are confused and false, as in the commencement of fevers. The entire head is usually affected with the sensation of pressure and throbbing;

there is throbbing over the forehead and vertex of the head, and a feeling sometimes of contraction and at others of a bursting sensation; or again, an uncomfortable feeling of pressure along the top and front of the head, followed by a continuous, dull, heavy pain across the frontal region. In others still there is an indescribable weight and confusion in the brain. There is throbbing of the carotids, buzzing in the ears, flashes of light before the eyes, conjunctivæ injected, face red and congested.

The passive variety is produced by any mechanical hindrance to the return of the venous blood from the brain, as tumors or glandular enlargements of the neck, valvular lesions of the heart, chronic disease of the lungs, or a persistent cough.

The symptoms in the main are similar to those of the preceding variety, but not so pronounced. The pain is generally frontal, but sometimes general. There is usually a dull and severe pain extending from the forehead to the occiput, and great heaviness and stupor; the face is bloated, the eyes dull, and the conjunctivæ injected; the expression heavy, the pulse full and soft, or weak, small, and accelerated.

In both forms the pain is increased by stooping, turning around quickly, or lying down; by long sleep, and by bodily or mental fatigue.

Nervous Headache.—This variety of headache is met with more frequently in persons of a nervous temperament and delicate organization, and where the brain is highly developed. It is due to a morbid change in the nervous center. According to Day, it is in the want of balance between the mental and physical state that a " nervous headache " originates; for when the circulation is energetic, and the digestive organs are in sound working order, the mind may be exerted to the utmost without the risk of incurring it.

Nervous headache is exceedingly irregular in its modes of attack, duration, and recurrence, as well as in the character of the pain. The attack sometimes comes on suddenly, when the individual is in a state of apparently sound health, and, after a longer or shorter period, leaves him as abruptly as it came, and with all his powers restored. In case the general health has been reduced, the attacks become more frequent and severe, and almost any cause induces an attack, and unless they observe the greatest care they will suffer the penalty of a headache for the slightest indiscretion. Severe mental exertion, excitement, worry, bodily fatigue, an error of diet, excessive indulgence in tea or coffee, or the slightest irregularity of living will often bring on an attack. The patient usually knows when an attack is coming on, by a sense of general uneasiness and discomfort, pressure in the head, ringing in the ears, chilliness, malaise, yawning, and frequently the passing of large quantities of limpid urine. Often, by extreme care, they may ward it off altogether; thus, at an early stage, its full force may be averted by going to bed and falling asleep, or by taking a cup of tea or coffee or a moderate meal. When the attack is fully ushered in, there are dimness or glimmering of sight and confusion of ideas. The pain is usually intense, and is located in the forehead and vertex, but sometimes the occiput and back of the neck. After continuing for some time, it often settles in one temple or in one eye, or in one side of the head. Sometimes there is a sensation as if the head were opening and shutting. Sometimes it begins in one or the other temple, passes through to the occiput, and extends down the cervical vertebræ, rendering the muscles of the neck stiff and painful to move from a fixed position. In many of the cases there is a tingling sensation of the tongue, arm, or body, as if the parts were asleep. This tingling sensation is usually on the same side as that on which the pain is located. When the nervous system has become exhausted, and the patient is low and depressed, the occipital region is more frequently affected. These headaches are usually attended with nausea and some gastric disturbances; the bowels frequently being constipated. The pupils are usually contracted and the extremities cold, with a sensation of heat in the head.

Neuralgic Headache.—This is one form of nervous headache. It affects one side of the head and face, or fixes on one particular spot, causing a sensation as though a nail were being driven through the head (clavus hystericus). The pain in some cases seems to extend through the head from front to back, or to pass through the eyes or the temples and emerge at the back of the head, and in some instances extending to the neck and upper extremities; the pain being described as similar to a hot rod or wire passing through the brain. The headache appears periodically. There is, as a rule, great tenderness of the scalp, and the pain is usually located in the occipito-frontalis and other muscles of the head and in certain branches of the fifth pair of nerves. It is increased, as a rule, at the menstrual period and by mental worry or trouble.

The true neuralgic headache seldom extends over the whole head, or produces sickness or vomiting, unless the attack has lasted long and is very severe. When nausea and vomiting occur, they follow the pain, and are the result, not the cause, and do not relieve as in gastric headache.

Day, in speaking of neuralgic headache, says that he should limit its strict definition to the intensity of the suffering, and its superficial seat; to the paroxysmal character of the pain, and its extension in the course of the superior branch of the fifth nerve, and those filaments which supply the orbits, inner angle of the eye, and forehead.

In neuralgic headache the pain is unremitting and severe, yet of short duration; but after it is over there is great lassitude, and even some local soreness. It is not attended with a rise of temperature, or with any signs of disturbance of the brain, except at times with a confusion of vision and an inability to carry on a concentrated train of thought. Many cases are accompanied by extreme sensibility to sound of any kind, or a distressing acuteness of hearing. There is pallor of the face, cold hands and feet, and a general sense of depression. This type of headache is met with more frequently in women who are debilitated from oversuckling, leucorrhœa, and menorrhagia. Exposure to cold, excitement, worry, exhaustion, mental strain or overwork, gastric irritation, or some local disease, as a decayed tooth, are all causes which may induce an attack.

Reflex or Sympathetic Headache.—This is another variety of nervous headache, the exciting cause of which is an irritation of the nervous system, often remote from the seat of the pain. It may be due to an ovarian, uterine, or rectal irritation—in fact, to an irritation of any of the thoracic, abdominal, or pelvic viscera. Another frequent cause is eye-strain from errors of refraction, strabismus, or ocular insufficiency. Sympathetic headache is of frequent occurrence in women of excitable temperament, and occurring periodically, before or after the menses.

The pain of this type of headache may be continuous, or there may be only occasional attacks. The pain may commence over one ear, shooting up to the top of the head, and then extend backward to the occiput. The pain is usually of a shooting character, as though a nail were being driven into the head; sometimes, however, the pain is of a smarting character, and is attended with a sinking sensation in the pit of the stomach. During the attack the patient feels cold, chilly sensations, extremities cold, head hot, face flushed, but later pallor. The sight is confused and dim, there is a buzzing or ticking sensation in the ears, and the general sensibility is increased. The pain is usually more severe in the morning and evening than during the rest of the day. The following has been given by Underwood as diagnostic of the seat of the irritation in reflex headache:

1. When the pain is located between the ears at the occiput, below the lambdoidal suture, the gastro-digestive apparatus, the automatic centers of life, and the sexual organs will be the seat of disturbance.

2. When the pain is located in the region of the parietal bone, from the coronal to the lambdoidal suture and from the squamous suture to the superior outline of the parietal eminence, the duodenum and small intestines will be the seat of the disturbance.

3. When the pain is located in the forehead, from the coronal suture to the superciliary ridges below, and within the

temporal ridges on either side, the large intestines will be the seat of the disturbance.

4. When the pain is located below the superciliary ridges, including the upper eyelids, to the external angular processes on either side, the nasal passages and buccal cavity will be the seat of disturbance.

5. When the pain is located in the temporal fossa, from the squamous suture to the zygoma below, and from the temporal ridge to the mastoid process, the brain and meninges will be the seat of disturbance.

6. When the pain is located at the vertex, from the coronal suture and two inches posterior to it in the median line, and two inches on either side of that extent, in the female the uterus and in the male the prostate gland will be the seat of the disturbance.

The pain from eye-strain is generally frontal or in the region of the eye (supraorbital), but may extend to the temples or occiput. It is aggravated by the use of the eyes, as after an evening spent at a theater or exposure to bright light. Sometimes there is no actual pain, but merely a sensation of a heavy weight at the back of the eyes. At other times, however, an overstrained eye-muscle may develop a sympathetic headache that will make life a burden rather than a joy.

Gastric or Bilious Headache.—This is often termed "sick headache," because vomiting dispels the pain like magic, the source of the irritation being so removed. It has its origin in imperfect digestion, and arises either in the stomach or duodenum. (Day.) The sympathy between the stomach and brain is so great that a little rich food, or noise, or shock, or fatigue, or exertion during the digestion of a meal, will often invite an attack. Any irritation of the stomach or intestines may produce headache by sympathetic disturbance. A genuine bilious headache is less common among women than men, for men are subject to greater excesses in eating and drinking. Young people of both sexes are, however, liable to it. The patient may go to bed feeling comfortably, after having partaken of a heavy meal, or after having drank a considerable quantity of wine, and either have disturbed or restless sleep, or wake up unrefreshed, with a weight across the forehead; soon the face becomes hot and flushed, with throbbing in the temporal arteries; then succeeds an oppressive frontal headache, aggravated by light and noise, and the thought of food causes a distressing nausea. As Gowers says, we do not know by what mechanism stomach disorder causes headache—whether it is by some influence in the cerebral vessels, or whether by absorption of some toxic material·from the stomach or bowels—some morbid secretion or product of the imperfect digestion of food, or altered bile.

The pain is of a continual shooting character, which may be diffused over the whole forehead and top of the head or concentrated into one small spot. In some persons the attack culminates in a fit of vomiting, which is followed by heat and a cessation of the pain; while in others colicky pains and diarrhea expel the irritating matter from the intestines, and the patient loses the headache more gradually. The duration of the attack is variable; in light cases lasting only a few hours, while in the severe form it may continue for several days, changing during its course from a bilious to a nervous, or from a nervous to a bilious headache. After the attack the patient for a few days is prostrated; the appetite is poor; there is dislike of food; there are high-colored urine and offensive evacuations; the tongue is coated; any attempt at mental labor causes vertigo and a throbbing headache. In many instances the attack occurs in persons of apparently vigorous health, without any traceable cause.

Rheumatic Headache.—This type of headache is met with chiefly in " rheumatic " subjects. It affects the fibrous tissues of the scalp—the occipito-frontalis and temporal muscles. It is caused by exposure to cold or changes in the weather, especially when north or east winds prevail. It is characterized by a severe, heavy, continuous aching pain of the scalp, jaws, teeth, and gums; a tenderness to touch. Sometimes the pains are of a tearing, stitching, burning nature, and have a tendency to shift from place to place. The face is sometimes flushed, and the eyes injected, but there is no throbbing of the temporal arteries.

In some cases the pain is paroxysmal and hemicranial, especially affecting the forehead and vertex, from whence it radiates in various directions. (Sieveking.) It is increased toward evening and before a storm, growing less toward morning, so that the days are more comfortable than the nights.

Catarrhal Headache.—This form of headache is due to inflammation of the mucous membrane of the nasal cavity and the frontal sinus. It is characterized by dull, aching pain and a sensation of a heavy weight in the forehead, and a tight, stuffy feeling at the root of the nose; or the pains may be of a shooting or burning character, radiating from the forehead to the side and top of the head. It usually begins in the morning on awakening, and continues through the day, with aggravation from motion. The brain is dull and heavy. There is a disinclination for any mental or physical labor. There is usually a sense of heat about the forehead, with throbbing and burning pains in the nasal and frontal bones and sneezing, accompanied by a profuse, watery discharge from the eyes and nose. Other cases are subject to a dull frontal headache, with pressure on the vertex, and an aching or smarting and burning sensation of the eyes. Rarely is there any nausea or vomiting.

There is a form of headache that would come under this subject, which Gray designates "headache due to the process of acclimation." It is not only observed in those who take up a permanent residence in a place, but in those who go to a different climate for a short time, as going to the mountains, seashore, etc. The headache is usually of a vague, diffuse nature, but may at times become quite severe, the pain settling over one eye; or an excruciating pain at the root of the nose, with sensation of heavy weight at the back of the eye.

Toxic Headache.—This form of headache is due to the absorption by the system of various poisons, whether generated in the system or introduced from without. The most common forms are those arising from uræmic, alcoholic, narcotic, lead, or malarial poisoning. The headache is sometimes intense; at other times dull and heavy. The pain generally occupies the forehead and both temporal regions. Sometimes the pain extends over the whole head; at other times it is confined to the vertex or occiput; there is a sense of heat, weight, and dullness; giddiness and confusion of ideas; inability to apply the mind to work, or to make any physical exertion; a general nervous prostration. In uræmic poisoning due to kidney disease the frontal headache is intense and excruciating, and is sometimes almost insupportable, and may last without intermission from the day of its commencement until drowsiness and stupor comes on, and the patient dies in a comatose condition. When the headache is due to alcoholic poisoning, it is usually associated with gastric disturbance, and resembles a gastric headache; but the tongue is usually quite clean, or has only a little white coating; never the thick, yellow fur at the back and sides that is always present in bilious headache.

Arthritic or Gouty Headache.—This is really one form of toxic headache, as it is due to an accumulation of morbid products in the blood, impairing the nutrition of the nervous tissue, and originating pain and suffering. It is met with in individuals of a gouty diathesis, or in persons whose general health has been impaired by previous attacks of gout. The pain is usually frontal and deep-seated, and so continuous that the nerve-structure is gradually brought to the verge of disease. In rare cases the pain is located in the vertex and back of the head, and is somewhat periodical in character. The tongue is generally clean or very slightly furred; the stools are either clay-colored or dark and bilious; the urine has a dark, reddish sediment. All these symptoms indicate a disordered condition of the functions of digestion and assimilation. A gouty headache may continue for years, and finally end in apoplexy.

Syphilitic Headache.—The poison may locate in any part of the brain or its membranes; or externally in the periosteum and the fibrous tissues of the scalp. When affecting the latter parts, the pain is limited to spots on the scalp, which are tender on pressure. The pain is always aggravated at night. Wells mentions a very striking symptom—pain across the forehead where the brim of the hat presses. The pain is due to subacute frontal periostitis, and if the system is saturated with the syphilitic poison, the specific inflammation may extend to the membranes, and eventually involve the brain itself. When the intracranial structures are affected, the pain sometimes is the most severe and obstinate of all the types of headache. The headache is a quasi-periodical headache, occurring toward night or during the afternoon, sometimes in the morning, and is accompanied by obstinate insomnia.

Migraine, Hemicrania, True Sick Headache.—This is a severe form of nervous headache, characterized by certain symptoms that distinguish it from the other types of headache. This affection was formerly thought to be due to vasomotor disturbance; but later researches show that it is due to functional derangement of the cerebral cells, and that the vasomotor disturbances are the consequence and not the cause. It is generally developed in later childhood and during early adult life, usually between the ages of ten and thirty, but may begin earlier or later. The interval between the attack lengthens and gradually passes away after the meridian of life has been passed. The attacks usually return with a certain irregular periodicity, occurring every two, three, or four weeks, and in some cases the interval may be shorter or longer. In women it is liable to appear either before, during, or after the menstrual period. In the great majority of cases it is hereditary, the tendency to headache thus transmitted presenting similar characteristics, and often going through whole families. It may be inherited *directly*, the father or mother (most frequently the mother) or some other member having suffered from migraine; or *indirectly*, some relative having suffered from insanity, epilepsy, or some other form of neurosis.

Migraine bears a curious relationship to epilepsy. In some cases both affections occurring in the same individual; others in which the migraine is followed in later years by epilepsy, migraine ceasing or becoming slighter when the epilepsy developed. Migraine also bears a peculiar relationship to the other forms of neurosis. It may alternate with some other form, or it may cease and some other nervous affection be developed. Individuals who are subject to migraine have no mental impairment—in fact, the most of them are above the normal in their mental capacity. Both Gray and Gowers say that *all* individuals of this migraine group are possessed of great nervous energy, and some of the finest mental work of the world is done by them. During the interval most patients are entirely free from all nerve disturbance. Some few cases, however, are subject to slight headache of a different character, or to neuralgia, or some other functional disturbance. The exciting cause of an attack is often attributed to mental overwork, fatigue of all kinds, excitement, worry, bright light, or an error of diet; but everyone who has suffered for years with these attacks knows that they often occur without explainable cause.

The symptoms in the majority of cases are typical of this form of headache. Preceding the attack several hours, or sometimes even the day before, the patient feels a heaviness in the head, a sense of languor, and aversion to food; there is yawning and eructation of gas, and the bowels are usually costive; in rare instances, however, there is a marked buoyancy of spirit preceding the attack. The pain is generally at first on one side, and is accompanied, or more often preceded, by visual disturbances, such as a bright spot, gradually enlarging, or a bright zigzag line of light, or a bright wavy or shimmering glare of light, or there is a dimness of vision. Very rarely there is double vision or half vision (hemianopsia) in which only half of the object is seen; for instance, in looking at a person, only half of the face is seen. Associated with the visual disturbance, there may be a tingling sensation, as of " pins " and " needles " in the hand, arm, lips, or tongue on one side; also difficulty in speech and confusion of ideas.

The pain is of great intensity, commences at one spot (usually the temple), and slowly spreads over the head. It may extend to the neck, or it may leave the side first affected to become agonizing on the other, or it may be bilateral, but it is even then greater on one side than the other. Occasionally it begins in the occiput, and then gradually spreads over the head. There are throbbing sensations within the head that send shooting pains with them of a severe character. There is a sense of chilliness, a feeling of great prostration, weakness, and trembling.

As the attack advances light and noise become unbearable and intensify the pain. The patient shuts himself up in a dark room, and though he may be able to doze a little, yet this does not relieve the pain. Accompanying the headache there is an increase in the saliva, which is quite profuse and of a salty taste; also eructations of gas and nausea, the nausea slowly increasing and at last ending in vomiting; then the sufferer goes to sleep for an hour or two, or for the night, and wakes up the next morning free from pain, and in many cases perfectly well; in other cases, however, there is languor, lassitude, disinclination to eat, or for mental work, bowels costive.

No one who has never experienced a severe attack can conceive of the suffering which such a patient endures. The attacks can rarely ever be cut short, but they can be mitigated in their severity. Every attack is not as severe as the one just described. In some cases the pain is not so severe, yet all the accompanying symptoms are present; again, the pain and sickness may be the only symptoms present.

In some forms of migraine the pupils are contracted, the face is flushed, the head hot, and the temporal arteries are dilated and pulsate strongly. This form is known as *hemicrania sympatheticus paralytica,* and is due to dilatation of the cerebral arteries. In others the eyes are prominent, the pupils dilated, and there is pallor of the face. This form is known as *hemicrania sympatheticus spastica,* and is due to spasm of the cerebral arteries.

Sometimes, however, these opposite conditions alternate in the same individual. These two types of headache are also known as the *congestive* and the *anæmic* variety.

TREATMENT OF HEADACHE—INDICATIONS FOR ONE HUNDRED REMEDIES.

Absinthium.—Dull occipital headache; fullness in the head; throbbing of arteries in head and neck; could not collect her thoughts; indifferent to everything about him; did not care to move about; sleepy, yet unable to sleep; restless at night; sensation as of a lump in the throat, with nausea after eating; twitching of facial muscles and eyelids; tingling sensation of the tongue; sensation as if the tongue were swollen; tongue coated white; aversion to food.

Aconitum nap.—The headache of aconite is characterized by congestion of blood to the head, with great heat and redness of the face; violent, stupefying headache, with great fullness and heaviness in the forehead; piercing and throbbing or pressure in the forehead, temples, and top of the head; the head feels light and constricted, with fullness and weight in the forehead as though everything would push out of the forehead; tight feeling over the root of the nose; fear and anxiety of mind, with great nervousness and excitability; burning, unquenchable thirst; feet and limbs cold. Headache aggravated by light, noise, or touch. Especially indicated in headaches following exposure to cold or in headaches of a congestive or an inflammatory nature.

Actea racemosa (cimicifuga).—Sharp, lancinating pains in and over the eyes; supraorbital pains shooting up to the top of the head; pains over and in the eyes, extending along to the occiput, producing a distinct sense of soreness in the occipital region; severe pains in the right side of the head; back of the orbits; brain feels too large, or as if pounded; pressing from within outward and upward; excruciating pains in the forehead, eyeballs, and temples, and increased by the slightest movement of the head and eyeballs; coldness of forehead; dull pain in the occiput, with shooting down back of the neck; top of head feels as if it would fly off; a sensation as if the vertex opened and shut; sensation of heat on top of the head; sensation as if the temples were compressed; waving sensation in the brain; dizziness on rising in the morning, with pain over the eyes; eructations with nausea and vomiting with headache; faintness and emptiness in the epigastrium; almost constant headache; headache aggravated from motion and on awakening; better in the open air and from pressure. Especially indicated in rheumatic and neuralgic headaches, and headaches from reflex ovarian and uterine irritation.

Æsculus hip.—A sense of fullness and pressure, rather than acute pain; sensation of fullness in head; beating of the temporal arteries, and pain extending through the head from one temporal region to the other; frequent, flying pains through the temples; dull frontal headache with constriction feeling of skin of forehead; dull pressure in forehead, with slight nausea, and accompanied by stitches in the right side; dull aching sensation in the back part of head, afterward extending to forehead; dull pain in the occiput, with flashes of heat over the occiput, neck, and shoulder; feeling as if a board was on the head, aggravated by rising from a seat; vertigo, with a sensation as if had to balance the head, worse in the afternoon; thick, yellow phlegm in mouth and on tongue; hard, dry stools passed with difficulty, with dryness of rectum and heat. Headache aggravated by stooping, laughing, or mental exertion. Especially suitable for persons with hemorrhoidal tendencies, and those who suffer from gastric, bilious, or catarrhal headache; also from sick headache.

Agaricus musc.—Dull headache, especially in the forehead; he must move the head constantly to and fro, and close the eyes; pressing in the right side of the head as if a nail was thrust in; dull, drowsy headache in the morning; extending into the root of the nose, with nosebleed, or thick mucous discharge; pain as though sharp ice touched the head or cold needles pierced it; icy coldness in the region of the coronal suture after scratching; frequent, slight twitching of the eyelids; twitching of the facial muscles; painfulness along the spinal column when stooping; sensation as if ants were creeping along the spine.

Headache better from pressure and when moving slowly about; worse sitting quiet. Indicated more especially in nervous headaches.

Agnus castus.—Tearing pain, especially above the right eye and temple, as if one had received a blow upon the eye, attended with soreness to touch; contractive headache above temples from reading; headache in upper part of head, as from staying in a room filled with thick and dusty atmosphere; looking to one point relieves it; pain in the temples as from blow; photophobia; low spirited; despairing sadness; melancholy; headaches of persons with derangements of the womb, ovaries, testicles, or sexual organs in general.

Alumina.—Headache, attended with nausea, pressure in forehead and congestion of eyes and nose, with nose-bleed; throbbing frontal pain, aggravated on going up or down stairs; burning, pressive pain, with heat in forehead, while sitting or standing, relieved in the open air; pain in the head and nape of the neck, it increases on going to bed, only leaves off in the morning on rising; sensation in head as if its contents were in a vise with a weight on top; heaviness of head with pale, languid face; vertex painful to touch; everything turns with him in a circle, attended with nausea; vertigo. Headache from chronic catarrh of the head; with constipation; relieved by lying quiet in bed or resting the head upon a cushion.

Anacardium.—Headache from overuse of mind; mental fatigue, mental exertion brings on a tearing headache, the pains being situated mainly in the forehead and back part of the head, or of a constrictive sensation, as though a band were tied about the head. Associated with the headaches there is great mental irritability.

Antimonium crud.—Splitting pain in forehead; dull, tearing pain, especially in forehead, temples, and vertex; violent headache after bathing, with weakness of limbs and aversion to food; headache over one eye, in a spot; aggravated at noon; relieved when in the open air and at night; not relieved by vomiting; aching in forehead; congestion in head, followed by nose-bleed;

dull frontal headache on awakening; disposition to take cold about the head from bathing. Headache in consequence of indigestion, or from a chill, or from the suppression of an eruption. Gastric headache from fruit, acid, or fat; a thick milky white coating on the tongue; stools white and lumpy; difficult hard stools; alternate diarrhea and constipation with old people.

Antimonium tart.—Heavy pain in forehead like waves, alternately increasing and decreasing; great restlessness, especially of upper extremities; frequent yawning, such as usually precedes syncope, with feeling as if about to faint; cold, clammy sweat on forehead and face; stupefying dullness, with unconquerable drowsiness; pressing pain in forehead with vertigo, stupor, and dullness of head; slightly delirious; drowsiness, but cannot sleep; headache as from a band compressing the forehead; feeling as if the brain was pressed together. Headache, aggravated in the evening, when lying down, when getting warm in bed, after eating, when sitting bent, and during rest; better when sitting upright, in the cold, moving about, and after washing the head.

Apis mel.—Burning, throbbing headache, aggravated by motion; general aching through the head; dull, heavy, tensive headache over eyes, with pain through the orbit; pressing, sometimes stinging pains in forehead; dull, heavy headache with slight erysipelas; inflammation about left orbit and down left side of the nose; severe neuralgia in and about left temple, with pain as if stung by a bee; accompanied by vomiting. Chronic headache, violent pain in forehead and temples, at times involving eyes, attended by vertigo, nausea, and vomiting; must hold head and eyes down. Nervous headache with indigestion; dull pain over the whole head, relieved by pressure; head confused and dizzy; vertigo worse when sitting, when lying down, and on closing the eyes; scalp very sensitive; puffiness of scalp, forehead, and around the eyes. Indicated especially in nervous headache or headaches of bilious or gastric origin.

Asafetida.—Pain in left side of head extending to the eyes;

changing into intermitting; severe pain, and slight fullness of the brain; a sudden pain in the left temple, like an inward pressing of a pointed plug; pressive pain in forehead and left side of the head from within outward; single, sudden, and deep penetrating stitches under the left frontal eminence, like sparks, followed by some sensitiveness; pain from within outward; swashing in the head; cold sensation in the head. All the headaches aggravated toward evening, in room, while at rest, sitting or lying; better when rising in the morning and in the open air. Nervous headache of hysterical or scrofulous people.

Argentum nit.—The characteristic symptom of this remedy is the sensation as if the painful parts were enlarged; the bones of the head feel as if they were separating, or the head feels as if it were enormously large; pressive, screwing, throbbing pain in one frontal protuberance, temple, or into the bones of the face; boring in left frontal eminence, aggravated at night in warm bed; complains of a constrictive pain in forehead, as if a small spot, size of a dime, was daily contracting and getting smaller; violent pressure in forehead, commencing over eye, spreading upward to coronal suture, worse in the morning, accompanied by severe vertigo; digging, cutting motion through the left hemisphere, from occiput to frontal protuberance; recurs frequently, increases and decreases rapidly; dragging pain in the right hemisphere of the brain; almost constant boring cutting in the bones of the forehead, vertex, temple, and face; the pains increase to such a degree that the patient almost loses his senses; frequent sensation of constriction of the scalp, as if something were tightly drawn down over the skull. Vertigo is almost always present when this remedy is indicated. The patient staggers and reels as if intoxicated. The vertigo is associated with general debility and trembling from nervous weakness. The headaches are attended with mental confusion, chilliness and trembling of the body, and intense nausea and vomiting. The symptoms are all worse in the open air; from mental labor; from warmth and at night; better from binding something tightly around the head. Indicated in nervous and syphilitic headaches and particularly in the habitual gastric headaches to which delicate or literary men are subject.

Arnica mont.—The pains are aching, darting, pressive, mostly in the forehead; aching in the forehead, commencing in the morning, gradually extending through the temple to the occiput, worse in the afternoon; pressive pain in forehead when walking, ascending stairs, reflecting, or reading; pressive pain in the forehead, as if the brain were rolled up in a lump, worse when near a warm stove; pressive headache as if the head were being distended from within outward; a pressure in the forehead as if these parts were crushed by a violent concussion; this feeling extends over the face into both cheeks; pain as if a knife were drawn through the head transversely from left side, with sensation of internal coldness of head; oversensitiveness of the whole brain, or of different parts of it; feeling at upper part of the head as though the brain were sore and tender; burning, or hot spots on top of the head; head hot, rest of the body cool; eructations frequent, empty, bitter; headache worse in open air, from moving the head, or from mental exertion. Indicated in congestive or gastric headache; also in headache from mechanical injuries.

Arsenicum.—The characteristics of the headache of arsenicum are periodical, burning pains with restlessness and anxiety; intense frontal headache with vertigo; throbbing frontal headache over the root of the nose; pain as if bruised or sore over nose and in forehead, relieved temporarily by rubbing; intermitting, tearing, burning, boring pain in supraorbital region, extending over eye and into upper teeth, better from walking about; tensive, pressive pain spreading from forehead and temples to occiput and nape of the neck; comes in violent attacks, as if the head would burst; violent, periodical headache; boring in a small spot in the temples; paroxysms of excessively painful hemicrania; feels like a hot wire were thrust through the ramification of the fifth pair of nerves; vertigo, when shutting the eyes, as if he would fall, when walking; puffiness of the face, especially about the eyes; feels chilly, sits around the stove; headache accompanied by nausea, retching, and vomiting of bile. Headache relieved by wrapping the head up warmly. Warmth in general relieves arsenic pains. This remedy is indicated in catarrhal, neuralgic, but more especially in anæmic headaches.

Aurum met.—Congestion of blood to the head, the brain feels sore as if it had been bruised; rushes of blood to the head, with violent palpitations, great anxiety and fainting; sparks before the eyes, and a glossy, bloated face; aggravated from mental exertion; tearing headache in front, in forehead, in vertex deep in the brain, abating in the open air; sick headache returning every three or four days, with stitching, burning, and beating in one side of the forehead, with qualmishness, nausea, and even bilious vomiting; disposition to grumble and quarrel and to fly into a passion; great mental weariness and depression, with thoughts of suicide (keynote of gold). Aurum is especially called for in nervous and congestive headaches; also headache from the effects of syphilis or mercurialization.

Baptisia.—Frontal headache with pain at the root of the nose; frontal headache with feeling of fullness and tightness of the whole head; heavy pain in the base of the brain, with lameness and drawing in the cervical muscles; dull stupefying headache with fullness; sensation as if a band were around the forehead; confusion of ideas; stupor, dull, heavy looking eyes; general debility; top of the head feels as if it would fly off; scalp feels sore; soreness of the eyeballs, with lame feeling on moving them; face hot and flushed. Especially indicated in toxic headaches the result of the various fevers.

Baryta carb.—Headache oppressive, just over the eyes and root of the nose; pressure in the brain under the vertex, toward the occiput on walking, with stiffness of the neck; pressure in occiput, with drowsiness and rheumatic pains; pressing pains as if the skull would split; headache generally occurs in the morning and afternoon; better when walking in the open air. Catarrhal headache and headache of drunkards. Headache of persons who are mentally and physically dwarfish. Headache of aged people, who are childish; sensorium not clear; loss of speech; trembling of limbs.

Belladonna.—Belladonna is our chief remedy in headaches. There is an incessant, dull, pressive pain in one or the other side of head. Headaches generally come on in the morning after a restless night. Boring, tearing, cutting, and shooting pains in various parts of the head, and worse on right side and in forehead, less in occiput; sharp cutting pains on the right side of the head, from the frontal to the occipital region, becoming general and at last settling in the parietal bone; painful pressure in head, especially in the lower part of the forehead, directly above the nose, intolerable on stooping or mental exercise; pain on stooping forward, as if everything would issue at forehead; boring pain under right frontal eminence, early in the morning soon after waking; violent frontal headache, with heat and redness of face and throbbing carotids; pain in head and eyeballs, eyes feel as if starting from their sockets. Hemicrania; pain extending into the orbits and bones of the nose, with a pressing, bursting, wavelike sensation. Nervous headache, right-sided, worse from 4 p. m. to 3 a. m.; worse from lying down. from light, noise, or any jarring; brain feels as if swashing about; severe pain in the vertex; stabbing as with a knife, from one temple to the other; driving patient almost wild; when the whole head is affected, the patient sits up with the head supported so as to keep it from bending; headache with dizziness, aggravated by stooping; rush of blood to the brain, purple swollen countenance, throbbing carotids and a pain in the head as if it would burst; or the face is pale and cold; or there is a dull, unbearable pressure in the brain as if it were cramped for room in the cranium. Jerking headache which becomes extremely violent on walking quickly, or going rapidly up stairs, and when at every step there is a jolt downward, as from a weight in the occiput. Gouty headache, most half-sided; flying stitches, felt very deep, sometimes commencing like a blow on a part of the head, passing over into a long and very painful stitch, drawing through whole half of head and lasting some minutes, often with loss of consciousness. The belladonna headache generally has a red face and violent throbbing of the carotid arteries; when stooping, or rising from a stooping position, has vertigo sparks and flashes of light before the eyes; dimness of vision or actual blindness; cannot look upward; eyes red, protruding, staring, and brilliant; pupils dilated; roaring ringing noises in the ears; vertigo, and intolerance of light, with vanishing of sight; vertigo, mostly at night on turning over in bed, or when getting up in the morning; also when walking and in every change of position; undulating, swaying sensation, worse from each motion, turning of the eyes, jar, or attempts to walk; great sensitiveness to cold air, can detect the moment a door or window is opened in any part of the house; takes cold from every draught of air, especially when uncovering the head; ill-humor, with paroxysms of rage with desire to cut or tear things. The belladonna headache is always aggravated by light, noise, and movement, and also by lying down; it is easiest in a quiet, sitting posture; also the headache ameliorated by letting the hair down, the integument of the scalp being so sensitive that pressure gives her pain.

Bromine.—Pain over left eye and left temple; left-sided headache; headache deep in the crown of the head, with palpitation; headache after drinking milk; headache brought on by going into the sun; disappearing in the shade.

Bovista.—Sensations as if the head were much enlarged; headache deep in the brain; morning headache relieved by eating; headache in the right side in the morning, on the left side in the evening; at night; at 3 a. m.; worse on raising the head; with increased secretion of urine; worse from sitting up and from pressure; pain in occiput as if a wedge would be pressed in; on awaking the head aches as from too much sleep; dull headache with weariness; menses flowing every two weeks; leucorrhœa, with sensation of extraordinary swelling of the head; leucorrhœa is yellow, green, acrid, and corrosive. Indicated in reflex headaches from ovarian and uterine irritation.

Bryonia alb.—The pain begins in the occiput or else in the forehead, going back into the occiput; pressive frontal headache, very much increased by stooping; headache in forehead and temples, with pressure from within out, and a sensation when stooping as though all the contents would issue from the forehead, better from pressing with the hands or a bandage; violent, stitch-like pain shooting through the eyeball, through the back of the head, or up toward the vertex; headache as if the head would split open; great heaviness of the whole head; weight upon the vertex; headache aggravated by any motion of the head or eyes; stitches in head from forehead to occiput, on stepping hard or when coughing; headache in the occiput, extending to the neck, arms, and face, becoming more of a beating pain as it increases in severity; headache in occiput, which extends to the shoulders, with a heavy, sore, bruised feeling of the muscles of the neck; obstinate headache with constipation; headache almost every day, beginning immediately after rising in the morning, and increasing during the day; worse from mental exertion and from coughing; with frequent vomiting of a bitter bilious fluid; stools dry, hard as if burned; great confusion in the head, especially in the frontal regions; dizziness on turning the head or on stooping; in the morning, on waking, the head is as confused and aching as if he had dissipated and been drunk the evening previous; does not wish to rise from bed; exceedingly irritable, everything makes him angry; heat of head, with dark red face, with coldness of the rest of the body, with much thirst and pain in the limbs when moving them; scalp very tender to touch; soreness in occiput behind the ears. The bryonia headaches are more frequently occipital. One prominent symptom that is characteristic of the bryonia headache is that, wherever there is pain, there is usually soreness. Bryonia is especially called for in gastric headaches characterized by vertigo, heaviness of head, pressure and rush of blood to the head, and also in rheumatic headaches occurring in cold, raw, wet seasons.

Cactus grand.—Heavy pain-like weight on the vertex, relieved by pressure, but increased by sounds or strong light; right-sided headaches and neuralgias which are periodical; pulsating and throbbing of extreme type; pulsating pain, with sensation of weight in right side of head, continuing day and night, so severe as to make him cry out; pressive pain in the head as if a great weight lay on the vertex, increased by the sound of talking, or any noise, better from pressure; pain commencing in the morning and growing worse as the day advances, until it becomes unbearable, with vomiting; must lie perfectly quiet; vertigo, worse on rising from a recumbent position; flashes of light in the face. Nervous sick headache occurring as a result of menstrual disorders, or dependent upon cardiac disturbances.

Calcarea.—The pains are chiefly felt in the forehead, on the vertex, or on either side of the head. Stupefying, oppressive headache in the forehead; frequent one-sided headache, always with empty eructations; pain of a dull pressure in the vertex, running into the forehead, or a drawing pain in the forehead with coldness in it, and nausea brought on or aggravated in the open air; throbbing headache in the middle of the brain every morning; continuing all day; pressive drawing headache through the day, concentrates about the right eye in the evening; sick headache on left side with scanty menses; on right side with profuse menses; tearing headache above the eyes down to the nose, with nausea; violent pressive pain, or throbbing pain in the vertex; weight on top of head; pressure in vertex and forehead, with irresistible sleepiness after dinner, and cold feet; headache begins in occiput and spreads to top of head, so severe that she thinks head will burst, and that she will go crazy; brain feels as if squeezed and relaxed alternately; stupefying headache, from 3 a. m. till afternoon; worse on rising, stooping, or mental exertion; better on closing the eyes; internal and external sensations of coldness of various parts of the head, as if a piece of ice were lying against it, with pale, puffed face; vertigo on going upstairs or up hill; vertigo on suddenly raising or turning the head, even when it rests. Associated with the headache there are usually nausea and vomiting. Other symptoms are a profuse sweating of the head; cold extremities; coldness of the feet as from damp stockings; icy coldness on head, or burning on top of head. In women the menses are too early, last too long, and are too profuse. The headaches of calcarea are worse from talking, going upstairs, or mental exertion; better from lying down, closing the eyes, vomiting, or from cold applications to the head.

Camphora.—Pressure in the occiput; nervous headache, with throbbing, like beats with a hammer in the cerebellum, synchronous with the pulse (pathognomonic); head hot, face red, limbs cool; better on standing; mostly with such as were deprived of sexual intercourse; contraction, as if laced together in cerebellum and glabella, with coldness all over; skin cold as marble, cannot bear to be covered; coldness of the extremities, with great prostration; great heat of head, hands, and feet, yet thirstless; rush of blood to the head, with heaviness of the head; better from external pressure. Congestive headaches. Camphor is the only remedy in the materia medica having the symptom of a beating pain in the cerebellum, *synchronous* with the heart beat.

Cannabis indica.—Dull, heavy, throbbing pain through the head, with a sensation like a heavy blow on the back of the head and neck; sensation as of a heavy weight at the back of the head, from which pains shoot up the side of the head to the temples and vertex; worse at midday; feels as if the head were opening and shutting at the top, and the head were being lifted off; throbbing of occiput; headache accompanied by flatulence, continuing until he can pass wind either upward or downward; aching in both temples, most severe in the right; jerking in right side of forehead, toward interior and back part of the head; severe stitch in the right temple, gradually changing to pressive pain; scalp and skin of forehead feels as though tightly stretched over the skull; soreness of scalp to touch; vertigo on rising, with stunning pain in back part of the head, and he falls moaning and crying; anguish, accompanied by great oppression, better in open air; nervous, easily agitated; backache, worse at catamenial periods, which recur every two weeks and are scanty. Called for especially in nervous and bilious headaches.

Carbo veg.—Dull headache in the occiput; violent pressive pain in the lower portion of the occiput; feeling of weight; head feels heavy as lead; pressive headache in forehead, especially just over the eyes; eyes pain on moving them; headache as the result of dissipation; headache particularly in the morning when the patient awakens from sleep; having spent the best part of the night carousing; dull headache referred to the back part of the head, with a great deal of confusion of mind; pain seems to go from the occiput into the head, and into and over the eyes, giving a dull, heavy aching to that region; sensation as if the hat pressed upon the head like a heavy weight, and the sensation continues even after taking it off, as if the head were bound up with a cloth; nausea, sickness at the stomach, sensation of a heavy weight in the stomach after eating; unable to take any fat food, whether meat, gravy, or dried food; cannot drink milk because it produces flatulence; he suffers from constipation with piles; the piles get worse every time he is on a spree. Headache worse in a warm room.

Caulophyllum.—Headache with pressure behind the eyes, and dimness of sight; severe headache over the left eye; severe pains, by spells, in the temples, as if they would be crushed together. Headache aggravated by stooping, light, from noon until night. Rheumatic or neuralgic headaches dependent upon uterine or spinal troubles.

Causticum.—Dull pressing pain in the forehead, with stoppage of the nose; pressive pain in the right frontal eminence; violent stitches in right temple, worse in evening; throbbing and stitches in vertex; nightly tearing and digging headache; with stitching and tearing toothache, and a sensation as if the teeth were loose and elongated; sensation as of an empty space between the forehead and brain; worse in evening and from cold; better from warmth; stitches in temples, worse from sitting or reading; rheumatic pains in head, so severe as to cause nausea; pains at a small spot in the vertex, as if bruised, only to touch; scalp very sore to touch. Vertigo during defecation. Rheumatic, arthritic, and syphilitic headaches.

Cedron.—The pains are of a shooting character, and located chiefly in the frontal region, often extending to the orbital region; shooting pain in orbital region, worse in left eye; headache especially deep in orbits, obliging him to shut his eyes, and extending to the occiput; pressing frontal headache with sharp pains from above to temples and occiput, worse before a storm; throbbing pain in head, commencing in temples, extending around to forehead; pressure at right temple, causing a dull pain in the whole right side of the head; disappears wholly toward noon; from temple to temple, pain across eyes; the eye burns as if it were on fire; distensive headache, worse during the night; head felt as if swollen. Attacks of headache recur with clock-like periodicity. Sick headache every other day at eleven o'clock.

Chamomilla.—Tearing headache in the forehead, with sensation as if a lump were falling forward, while sitting, or turning over in bed; jerking headache in forehead, especially after eating; pressive pains in both temples, like from pressure with thumbs, worse forenoons; pressure, extending from vertex to forehead and temples, worse from thinking of it, from sudden stooping, or from mental exertion; wandering pains in the temples, frequently recurring and always worse in the beginning. Nervous arthritic or rheumatic headaches. The great indication for the use of chamomilla is to be found in the mental condition of the patients. They are extremely restless, impatient, cross, irritable, and peevish. Chamomilla seems to act specially upon a morbidly sensitive nervous system.

Chelidonium.—The attack is characterized by darting, tearing, throbbing pains in forehead and temples, with heaviness and coldness in occiput, accompanied with vertigo, anxiety, melancholy, nausea, and bilious vomiting. Tensive pain in forehead, as from a load above the eyes; violent neuralgia over right eye, extending into eye and cheek; pain extending to forehead and all over head, beginning at 2 or 3 p. m., at its height at 8 or 9 p. m., preventing all sleep or even lying down till nearly daybreak; pressure in occiput; drawing in nape and occiput, with drawing in neck from above downward; occiput feels heavy, as if it could not be raised from the pillow; drawing, pressing-like stitches, extending from left side of occiput to forehead; coldness in occiput, rising up from nape of neck, worse when moving; better during rest; pressive headache, with frequently recurring heat of face. Sick headache every fortnight, with pain in right hypochondrium, pain worse in the right temple and forehead, accompanied by nausea and bilious vomiting. Vertigo with bilious vomiting and pain in liver, with confusion of head; on sitting up; on closing the eyes as if everything were turning in a circle; grayish-yellow, sallow, sunken countenance; tongue thickly coated yellow, with red margin, showing imprint of teeth; bitter taste in mouth; mucus in mouth and tough mucous saliva; loss of appetite with disgust and nausea; hard and whitish-yellow stools, or diarrhea and constipation alternately. Headache aggravated in open air, when coughing, blowing the nose, and stooping. Indicated especially in gastric or bilious headaches.

China.—The pains of china are of a tearing, jerking character, usually on one side of the head; headache first like a cramp in the vertex, followed by a bruised sensation in side of the head, aggravated by the slightest motion; headache from occiput over the whole head, from morning until afternoon; worse lying, must stand or walk, drives to madness; headache so sensitive that it seems as though the skull would burst; brain beats in waves against the skull; sensation as if the head would burst, with sleeplessness; worse from motion or from jar; better in room and when opening the eyes; intense throbbing headache; carotids throb; after loss of blood; headache as if the brain were pressed together from both sides, and out at the forehead, very much increased by walking in the open air; stitches in head with pulsations in temples which can be felt by the finger;

relieved by hard pressure, but increased by movement of head; stitches from temple to temple; brain feels bruised; worse on moving, opening the eyes, at night; the scalp sensitive. Neuralgic headache, first on left, subsequently on right side, beginning in the teeth or jaw and extending to the ear, temples, and vertex, aggravated by a current of air or by taking anything cold or hot in the mouth and at night, better by external warmth; scalp sensitive to touch, feels as if the hair were grasped roughly; headache every other day; head much confused in the morning, as after intoxication, feels weak, can hardly hold it erect; ringing in the ears, and weak, fainting spells; sleepless at night, lies awake thinking; restless, uneasy, and miserable next day; of a quarrelsome or discontented disposition. Headache worse from stepping, walking, every motion, and from the slightest touch; better from lying down when everything is quiet and from hard pressure. Anæmic headaches, and headaches from general debility.

Cina.—Stupefying headache, especially in forehead, then also in occiput; when walking in the open air; dull headache, with sensitiveness of the eyes in the morning; stupefying headache, brought on by eating or from mental labor; weak, hollow, empty feeling in the head, with inclination to vomit; a slow stitch, extending from upper orbital margin, deep into the brain; drawing pain in right temple, in a vertical direction; on coughing feels as if it would burst; drawing from left frontal eminence to root of nose, causing confusion of head; on the middle of the vertex an intermitting pressure as from a heavy weight, as if the brain were pressed down; pressure increases and renews the pain; child rubs the nose constantly, and bores with the fingers into the nose until blood comes out. Especially called for in headaches of children.

Coffea cruda.—One-sided headache as if a nail were driven into the parietal bones, or as if the whole brain were torn and bruised; worse in open air; headache intolerable, head feels small, and as if it were filled with fluid, as if it would burst or fly to pieces if she moved; feels and hears a cracking in vertex when sitting quietly; headache from the slightest cause, from thinking, vexation, catching cold, etc. Sick headache with vertigo, flushed face, burning in the eyes, throbbing in the temples; headache renewed and increased after eating and sleep; it disappears in the open air and returns in a short time in room; excessive sensibility to noise, music, and especially to pain; the pain seems unbearable, making patient lose all self-possession; throws herself about, crying violently, dreads the cold air and is chilly. Nervous hysterical headaches in people of a nervous or sanguine temperament.

Cocoa.—Dull frontal headache, which vanishes with the setting of the sun, followed by a state of mental exhilaration; headache in the right temple in the morning, sharp when first rising, and all day when looking up; pain darts from temple in straight line to top of head, leaving a sore feeling behind; pressing headache on right side of occiput and on right side of forehead, with giddiness and chill after dinner; better toward evening; shocks in the head; dull, full feeling in occiput, with vertigo aggravated by lying down, often only possible position in bed is on face; headache after eating, returning in three and a half hours, and leaving at sunset. Nervous sick headache, migraine.

Cocculus indicus.—Intense headache in the occipital region, in the lower part of the back of the head, and in the nape of the neck; headache in the occiput and nape of the neck, pain as if opening and shutting like a door; headache, pain extending down the spine; head hot; eyeballs protruding; violent, dull headache; cannot lie a moment on back of head; forced to lie on one side; cannot bear the least light; noise excites nausea and a feeling of seasickness; objects seemingly move up and down; pressing pain in forehead, from without inward, with nausea; aggravated by riding in a wagon; reading and thinking; from eating, drinking, and sleeping; better during rest and indoors; headache as if something forcible closed the eyes, or as if the eyes were being torn out; headache with nausea and inclination to vomit; headache is painful as if bound up, as if tightly bound by a cord, as if the nerves in the head were drawn up tightly; violent headache, which compels the patient to sit up, aggravated by talking, laughing, noise, or a bright light; vertigo as if intoxicated; with confusion of mind; with nausea when rising from a recumbent position; things whirl from right to left; with dullness in the forehead, as if there was a board across the head; with pressure in forehead; with flushed, hot face and head, following palpitation of the heart. Sick headache from riding in a carriage, boat, railroad train, etc. Indicated in congestive, gastric, reflex, and sick headaches.

Colchicum.—The headaches are of a pressing, boring character; pains mostly located in the forehead or occiput; pressing pain in right and afterward in left frontal region; boring headache, especially over the eyes, extending into the dorsum of the nose; pressing heaviness deep in the cerebellum, especially on moving or stooping; boring, pressing headache, brought on by mental labor, and by entering a room from the open air; headache coming on in the evening, very violent and lasting until morning; patient of an irritable, peevish disposition; easily put out of humor. This remedy is especially useful in rheumatic, gouty, and arthritic headaches; also, the headaches of old people.

Colocynth.—Intermittent headache in those of a rheumatic, gouty, or nervous diathesis. The pains are violent, semi-lateral, tearing, drawing; or crampy, aching, compressive sensation in forehead, accompanied with great anguish and restlessness, obliging one to leave the bed; violent shooting or stitching pain in forehead and eyes, from out in, sometimes lessening for a few minutes, but returning afterward harder, day and night; tearing or pressing pain in forehead and root of nose, as if a coryza would appear; severe headache, with sweat on head and body, smelling like urine, with copious, watery urine during pain, or scanty, fetid urine between the paroxysms; sensation of violent pressure in the left temple, continuing the whole afternoon; one-sided headache with nausea and vomiting. Headache aggravated afternoon and evening; when stooping; when lying down; on moving upper eyelids; from motion and while in the open air; better while seated and from touch or pressure.

Conium mac.—Darting, tearing pains, chiefly in the forehead and vertex; stitching pains from within outward, in forehead, morning or at noon; stitches in top of head; tearing in temples and at sides of head, with the sensation as if the brain had gone to sleep, aggravated by contact, motion, after eating, and by a recumbent position, or while stooping; stupefying headache first in the forepart of the head, later in the back part, with coryza, aggravated by open air; congestion to head with catarrhal sensation and heat of face; semilateral, gradually increasing headache, as if the head had been bruised, and as if a load were pressing down on it; this sensation is increased by moving the head toward the affected side; clinking noise in the left vertex, on walking and during stool; also in occiput on walking, especially in evening, when tired; pain in occiput with every pulse as if pierced with a knife; confused feeling in the head, often sits lost in thought; feels peevish, irritable, gets out of temper easily, and the sight gets blurred and the face becomes pale. Sick headache, with inability to urinate; great giddiness, worse lying in bed, when everything in the room seems to go round. Dysmenorrhea, pains in the hypogastric region and down the legs; sharp pain in the back; menses too soon, too profuse; nose-bleed, with suppressed menses, from taking cold. Chiefly indicated in reflex headache from menstrural and uterine disorders.

Cyclamen.—Migraine, which commences by an obscuration of sight and sparks before the eyes. As the vision returns the headache increases and the head seems about to burst. Scintillations preceding headache, which is mostly left-sided, worse after rest and in the open air.

Dulcamara.—Boring, burning in the forehead, with digging in the brain; worse from motion or talking; head heavy; increased flow of saliva, with dryness of tongue and thirst; pulse hard and tense; great weakness and prostration in the limbs; stupefying ache in occiput, ascending from nape of neck; bursting pains, extending from the forehead to the bridge of the nose; sensation of chilliness in the cerebellum and over the back; feeling as if the hair stood on end; recurs every evening; momentary vertigo; vertigo when walking, on awakening in the morning, dizzy; dark before the eyes; dullness and painful stupefaction of the head; sensation as of a board pressing against the forehead; continual dull pain in the head and chest and stomach, with great uneasiness and depression of spirits; labored respiration; mental confusion and inability to concentrate the thoughts. Especially adapted to catarrhal and rheumatic headaches, which are worse in damp, cold weather.

Euonymin.—A heavy, wearing occipital headache, with bowels neither loose nor constipated, but generally regular but deficient in bile; yellow tongue, slow pulse, bitter eructation. Bilious headaches.

Eupatorium perf.—Throbbing headache; pain extending from forehead to occiput, worse on the left side; darting pains through the temples, with sensation of blood rushing across the head; painful soreness over right parietal protuberance; heat on top of head, with pain, relieved by pressure; soreness and pulsation in back of head; pain in the occiput after lying, with sensation of a great weight in the part; headache and nausea every other morning, when awakening, continues all day; severe, aching distress and soreness of the back and limbs; headache better in the house, aggravated when first going into the open air; relieved by conversation. Suitable in bilious headaches and headaches characterized by periodicity.

Euphrasia.—Dull headache, headache as if the head would burst, with dazzling of eyes from sunlight; headache in evening as if bruised, with coryza; dullness of head, with pressure on the vertex; profuse, fluent coryza, with smarting lachrymation and photophobia, or with sneezing and discharge of mucus. Catarrhal headache, headache accompanied by profuse watery discharges from the eyes and nose.

Ferrum.—Dull, pressive sensation in frontal eminence, afterward spreading over the whole forehead and finally the vertex;

relieved by pressure of the hands and in the open air; worse on going downstairs; hammering, violent, shooting headache in left side, in afternoon; headache on top of head, as if skull were pushed up; boring pain, beginning mostly in left temple, with sensation of expansion of blood-vessels in the temple; drawing from nape of neck upward into the head, with stinging, hammering, and roaring in the head; headache for two or three days every two or three weeks; hammering, beating, pulsating pains; must lie down in bed; worse after twelve o'clock at night; with aversion to eating and drinking; vertigo; on rising suddenly things grow black; vertigo, with sickness of stomach in walking; head hot and extreme paleness of the face, which becomes flushed or fiery red on the least motion, pain, or exertion, with vertigo, ringing in the ears, great palpitation of the heart and dyspnœa. Called for especially in headaches of anæmic, debilitated persons, especially with congestion of the head or chest.

Gelsemium.—Pain in the forehead and temples; severe and continued pain, day and night, accompanied by dizziness when stooping, and a sensation as if he would fall headlong; tongue coated; appetite poor; pain worse in the frontal region, but at times extends over the entire head; fullness in the head; heat of face; chilliness; pulsation of the carotids; thick speech; brain feels as if bruised; heaviness of head, slightly relieved by shaking head, better after profuse micturition; sick headache, principally in the right temple, beginning in morning and increasing during the day; worse from motion and light; better after lying down, and from sleep or vomiting; band-like pain surrounds head, with shooting pain in each jaw. Blind headache, shooting pains into ears, when swallowing, cannot sit or lie, must stand or walk; headache, with soreness of the eyes when moving them; headache with cramp-like drawing, tearing pains, commencing in the upper cervical and occipital region, extending upward and forward, and terminating in a bursting pain in the eyeballs and forehead; worse about 10 a. m. and from lying down, accompanied by vertigo and dimness of sight, nausea and vomiting, cold sweat on forehead and cold feet; headache beginning in the nape of the neck and settling down over the eyes, usually worse in the morning, and is accompanied by a stiff neck; mind confused; cannot fix his attention; eyes grow heavy and bloodshot; relieved by the discharge of profuse and pale urine; dull, dragging headache, mainly in the occiput, mastoid, or upper cervical region, extending to the shoulders; relieved when sitting, by reclining the head and shoulders on a high pillow; headache coming on suddenly, with dimness of sight or double vision; with vertigo, great heaviness of head; it feels too large and often too light; semi-stupor, bright red face; dull, heavy expression of countenance; full pulse; general malaise; patient desires to be quiet, does not wish to speak, nor have anyone near for company, even if the person be silent; dullness of the mental faculties; vertigo; confusion of head, pain spreading from occiput over whole head; pupils dilated; general depression. Headache worse in the forenoon, when lying down; better by profuse emission of watery urine; when sitting, by reclining head and shoulders on a high pillow. Catarrhal, nervous, and neuralgic headaches; also migraine.

Glonoine.—Headache from below upward; throbbing headache; the pain may be in the whole head, or it may be in the forehead, vertex, occiput, or any part of the head; the throbbing is not a mere sensation, but an actual fact; the blood seems to surge in one great current up the spine and into the head; throbbing in temples, in vertex, in occiput—in whole head; sudden sensation as if the whole head were crowded with blood; constant sensation of fullness in vertex, increasing all the time as if something were pumped in; head felt throbbing and bursting, especially above ears and at temples; choking sensation as if a ligature were tied around the neck, which prevented the blood returning from the head; throbbing in the whole head, especially in the temples and over the eyes, with excessive heat in the head; worse when moving; better when sitting still and lying; also relieved by pressure upon it; tensive pain over the eyes and nose, also behind the ears, followed by choking sensation about the throat; headache beginning in the occiput, and spreading from there over the whole head; face flushed; throbbing in the temporal arteries, which were raised and felt like whip cords; fullness in the base of the brain and violent throbbing of all the arteries of the head and back of the neck; congestion to occiput like pressure; such excessive determination to occiput that it seems as if he would lose his reason; pain, heat, and fullness in head ascend from the chest, neck, or back part of the head; fullness in the head, as if the brain were expanding itself, were moving in waves. Headache of typesetters and of men who work under gaslight steadily, so that the heat falls on the head. Headache begins with warm weather, and lasts all summer, increases and decreases every day with the sun; great sensitiveness to rays of the sun and to pressure from covering of head. Congestive headaches.

Graphites.—Headache during and after a meal; pain as from bruise in the head, with general sick feeling in the evening; violent headache, with eructations and nausea during menstruation; oppressive headache on top of the head; pain as if the head were numb and pithy; frequent congestion of the head and chest; dark red cheeks; oppression and anguish when lying down (amenorrhœa); pain as if constricted, especially in occiput; extending to nape, with pains on looking up, as if broken; sensation as if the skin of the forehead was drawn into folds; boring, round spot on top of the head; sweat on head when walking in open air; moist, sticky eruption on scalp; taste in mouth as of rotten eggs every morning; sweet things are disgusting and nauseating; aversion to animal food; tongue coated white; heaviness in abdomen; constipation; stool large, knotty; urging and sticking in anus. Headache due to suppression of some eruption.

Hamamelis.—Fullness in forehead, with pressing in root of tongue; crowding fullness in head and neck, also in forehead; feeling as if a bolt was passed from temple to temple and tightly screwed; distressing throbbing, aching, and a sense of fullness in the head; head feels as if it would burst; face flushed; bursting headache on awakening, insupportable or bending downward; epistaxis, with a feeling of tightness of bridge of nose and crowding pressure in forehead between the eyes. This remedy is specially adapted to headaches accompanying venous congestion of the brain, lungs, portal or general venous system, especially if followed by nose-bleed.

Helleborus.—Pressing headache from outward inwardly with stupefaction and heaviness of the head; worse from moving the head; from exertion; better in the open air and from distraction; stupefying headache, with coryza (4 to 8 p. m.); worse from stooping; better from rest and in the open air; sensation in occiput as from a blow; stupefying headache in occiput, worse from stooping, from nape of neck to vertex, changing to burning pain on rising to erect posture; better only on lying quiet with closed eyes; boring with head in pillow, with sensation as if scalp were pulled down tight; vertigo when stooping, ceasing when becoming erect.

Hepar sulph.—Aching in forehead as if bruised; like a boil; from midnight till morning; burrowing headache in frontal region, as if an abscess were forming; headache with a feeling as if eyes would be drawn back into the head; headache over eyes; pressing down upon eyes; boring headache at root of nose every morning; in right temple from without inward; worse from motion or stooping; tensive aching pain above nose; violent headache at night, as if the forehead would be torn out, with general heat, without thirst; constant pressive pain in half of brain, as from a plug or dull nail, at night and when waking in morning; worse from moving eyes or stooping; better when rising and from binding the head up tight; dull headache every morning in bed, better after rising, when walking in the open air; great sensitiveness to touch, draught of air, or other impression on the senses; sensitiveness of scalp to touch, with burning and itching in the morning after rising. Headache from abuse of mercury. Rheumatic and arthritic headaches.

Hyoscyamus.—Pressive, stupefying headache in the forehead; constrictive, stupefying headache in upper part of forehead and general malaise, alternating with absence of all pain; heaviness, vacant feeling, confusion, severe pain; pain in mornings; pressure in left side of forehead, changing to shooting; heat and tingling in the head; violent pulsations like waves, head shakes; worse on becoming cold, and after eating; better bending head forward and from eating; congestion of blood to the head; red, sparkling eyes; face purple, red; worse in evening; pain and heat in head after eating. Headache better walking. Nervous headaches.

Hypericum.—Severe headache on vertex, as if the whole brain would burst; pain extending into cheeks and chin, with cramp in them; brain seems compressed; feeling as of something alive in the brain at night in bed; sensation as of hammering in the morning, worse on the vertex.

Ignatia.—The headaches are characterized by a predominance of *pressure;* the pain goes to the eye, which feels as if pressed out, or to the root of the nose. The headache is usually situated in one spot in the head, as if a nail were driven into the spot; pain unusually semilateral; begins often in the ear and behind the mastoid process, and runs up the parietal bone or back to the occipital protuberance, leaving a stiffness in the nape of the neck; pressive headache in the right side of the forehead, extending down into the right eye; it seems as if the eyeball would be pressed out; burning in the eyes and increased lachrymation with mucus; intense pain over right eye, and seemingly through supraorbital foramen; pain as if a needle were pushed through into the brain; pressure from without inward; pain beginning in the forehead, drawing, extending down one-half the nose; pain extends to middle of vertex, where there is a pressure as of a weight, with nausea and tendency to vomit; worse of morning until afternoon, then gradually getting better until evening; sensitive to least noise or loud talking; pale face, suffering expression; dull headache, confined to right half of head, involving the right eye, which is very sensitive to light; stabbing pain, deep seated in the eyes; going to the occiput and nape of the neck, and finally to vertex; pain very acute, driving him almost frantic; pain generally begins on rising in the morning, is at its height at 4 p. m., and passes off with a night's rest; better from warmth, worse from sound; irritability of disposition day before headache; scalp tender to touch, and dull, uncomfortable feeling, as if the headache might return day after; pain as if a nail were being driven out through side of the head, better from lying on it; pressive, drawing headache above right orbit, at root of nose, renewed by stooping low down. Headache like a pressure, with something hard on upper surface of brain; in paroxysms; throbbing pain in occiput; worse from cold, snuffing or smelling tobacco, when pressing at stool; better from external heat; weight in back of head, tendency of head to incline backward against back of chair, probably from congestion of cerebellum; periodical headache, weekly, fortnightly, or monthly; increases gradually in severity and then suddenly abates; a fit of vomiting, or a profuse flow of colorless urine terminating the attack: at the height of the paroxysms the patient complains of vertigo on the slightest motion of head, especially when stooping; intense photophobia, zigzag flashes of light or a shimmering of light, great prostration, nausea, and there is an increase of saliva and great chilliness. Headache aggravated by cold winds, turning head suddenly, at stool, stooping, change of position, running, moving eyes, inhaling tobacco smoke, mental exertion, noise and light; relieved by warmth, rest, and sometimes by stimulants. Headache from abuse of coffee; from smoking or from abuse of snuff; from inhaling smoke; from being where others smoke; from tobacco or alcohol; from close attention. Especially adapted to nervous and neuralgic headaches and migraine.

Iris versicolor.—Headache always beginning with a blur before the eyes. Sick headaches, periodical in their appearance, recurring every Sunday; this is because the strain of the preceding six days has been relieved and the patient feels the effect of the strain, and has this sick headache. The pains are intense and of a throbbing character, and supraorbital; may be in either side, but only on one side at time; dull, heavy, frontal headache; chronic frontal headache; worse sitting down, studying, or sewing; better standing up or working; a tired, aching headache from mental exhaustion, with violent pains over the eyes, in supraorbital region, recurring on either side, but only on one side at a time; headache in forehead and eyes, worse on right side; with distressing nausea and vomiting of intensely sour, bilious matter; worse from rest; relieved by constant motion; accompanied by low spirits; dull throbbing or shooting in right side of forehead; nausea; aggravated toward evening; from rest, from cold, air, or coughing; better from moderate motion. Sick headaches in bilious subjects, with gastric derangements and dyspepsia, tenderness in the region of the stomach and liver at the height of the headache, vomiting often occurs, the vomited matter being bitter, sour, or both. Headache most severe in afternoons and toward evening. Sometimes called the " Sunday sick headache remedy," because it is generally indicated in those sick headaches that come every Sunday. Especially adapted to gastric or bilious headaches and headaches of school teachers, college professors, students, etc.

Ipecac.—Headache over left eye; stinging headache, with heaviness of head, also with drowsiness; pain as if the head and bones of the head were bruised or crushed, this feeling seeming to go down into the root of the tongue, accompanied by nausea and vomiting; sick headache with deathly nausea, face usually pale, blue rings surround the eyes, and the expression of the mouth betraying the intensity of the nausea; bursting headache, with a bruised feeling here and there in the brain; headache as though the brain were mashed; pain in occiput and nape of the neck; tensive headache in occiput and nape of the neck, extending as far as the shoulders; aversion to all food; no appetite; tongue clean, or a white, thickly coated tongue; distress in the stomach; it feels as though relaxed, as if hanging down; nausea, an indescribable sick feeling in the stomach; diarrhea; stools as if fermented; stools green as grass; headache better out of doors. Gastric headache occurring in nervous, sensitive persons, commencing with nausea and vomiting. Continuous nausea and vomiting, or both, is the keynote for the selection of ipecac.

Juglans cinerea.—It is one of the best remedies in occipital headache. The pains are of a sharp, shooting character, with stitching pains about the liver and pain under the right scapula. The patient wakes at three in the morning, and cannot go to sleep again; stools bilious or yellowish green, burning the anus, and associated with tenesmus; there is often a jaundiced condition.

Kali bich.—The patient is affected with blindness, more or less marked; objects become obscured and less distinct; the headache then begins; it is violent, and is attended by aversion to light and noise, and the sight returns as the headache grows worse; headache comes and goes with the sun, and is accompanied with nausea; soon after dinner a dull, heavy throbbing above the eyes, as if the head would burst; relieved by lying or pressing the head against anything, or in the open air, worse stooping or moving about; acute throbbing pain in the center of right eyebrow, commencing in morning, lasting all day, and accompanied by persistent retching and vomiting of food and bile, without relief; violent pain in left side of head at zygomatic process; worse when lying on it; pain shooting inward and toward the throat; gastric symptoms present; periodical attacks of semilateral headaches in small spots that can be covered with the point of the finger, accompanied by nausea, eructations and vomiting; headache from suppression of discharge from the nose. Catarrhal and rheumatic headaches.

Kali carb.—All the pains are of a stitching character; stitches in the forehead, also in the temples; worse stooping, moving head, eyes, or jaw; better raising the head and from heat; stitches into the eyes and root of the nose, with catarrh; pressive and drawing tearing in forehead, extending into eyes and root of the nose, with heat in face and head; headache from riding in a carriage; from coughing or sneezing; from coryza; morning headache with vertigo, aching and stitching in the occiput, felt only during motion; sharp shooting pains from the upper dorsal spine into the occiput. Headache with a *small bag of water above the upper eyelid.* Congestive and catarrhal headaches with a dry hard cough.

Kalmia.—Kalmia has severe sun headaches; severe pressing pains, increasing with the ascending and descending with the declining sun; pulsating headache, as if a pulse was beating in the forehead; pressing pains in a small spot on the right side of the head; neuralgia more on the right side of the head.

Kali iod.—Excruciating pain at the root of the nose and over the frontal sinuses, with the feeling as of a band around the head; a profuse, non-irritating secretion from the nose; pains in the sides of the head, as if screwed in, better in the open air; severe headache with lachrymation. Acute catarrhal headaches with inflammation of the mucous membranes of the frontal sinuses, eyes, throat, and chest. Rheumatic headache of the external part of the head, the aponeurosis of the occipito-frontalis muscle; hard lumps like nodes on the scalp, which pain excessively. Headaches the result of syphilis and mercurialization.

Lachesis.—Pressing headache early in the morning, worse from stooping; cannot bear anything tight around the waist; frontal headache; faint on rising; violent frontal headache, when the nasal discharge suddenly dries up, better as soon as the discharge reappears; heavy pain in forehead extending to back and sometimes all over the head, coming on at any time of day; dull pain over and in eyes; nausea; pain in top of head; giddiness on rising; pressing or bursting pain in one or the other temple, worse from motion, pressure, stooping, or lying down; headache worse in or over the left eye, of a throbbing character, with sharp pains, very severe, which may come at the climax, or as the accompaniment of an ordinary cold, relieved as soon as the coryza appears; left-sided, orbital neuralgia with lachrymation; previous to the paroxysm, rising of heat to head; during intervals a weak, nauseous feeling in abdomen; semilateral headache in right side, creeping gradually to left, until it goes around the head; twitching in the eyes when fixed upon an object; menses irregular; headache on the right side extending to neck and shoulder, with stiffness of neck; beating headache with heat, worse in vertex and right side, or over eyes, preceding a cold in the head, with stiff neck, burning vertex; headache during menopause; pressure on top of head, with hot, throbbing temples; any excitement causes headache; constipation; menstrual disorders; giddiness with headache, particularly before the menses; headache after a cold; first a pressure in the forehead, which increases to a violent beating in the evening, with nausea and inclination to vomit; face puffed, dark red; confusion of mind; partial blindness; palpitation of the heart and fainting. Catarrhal, congestive, neuralgic, rheumatic, reflex headaches. Especially suited to headaches accompanying menstrual irregularities, and to women at the climacteric period. Farrington says that there is a universal characteristic of lachesis, namely: *as soon as a discharge is established the patient feels better.*

Lac. defloratum.—Intense headache, located principally in the fore part of the head. The pains are of a throbbing character and are associated with nausea, vomiting, and obstinate constipation. It is especially suited in anæmic women.

Lilium tig.—Dull, frontal headache, worse over left eye, or alternating from side to side; blinding pain in forehead, worse in evening, extending into back of head and down neck, with strange muddled feeling in head, general weakness, and a desire to lie down; pains in forehead and temples, with vertigo and depression of spirits; constant bearing down in the lower part of the abdomen, with severe pressure in the ovaries and rectum, with ineffectual desire to stool; bearing down pressure in the vagina, as if everything would be pressed out, worse from rising up and from standing; profound depression of spirits, can hardly keep from crying; disposition to weep, with nausea and pain in the back; aversion to food; weeps much, and is very timid; indifferent about anything being done for her; vertigo, especially when walking; faint in a warm room and when standing, with cold sweat on hands and feet; frequent urination through the day, with dull headache moving from the sinciput to the occiput, finally settling in left temple; urine milky, scanty, and high colored; hot like boiling oil; patient finds relief in diverting her mind by busying herself. Called for especially in reflex headache, due to menstrual irregularities arising from prolapsus or malposition of the uterus. Profound *mental depression* with *frontal headache* is a leading keynote for this drug (from uterine displacements).

Lycopodium.—Tearing in forehead or right side of the head; extending down to the neck, with tearing in face, eyes, and teeth, worse on rising, better lying down; pain in the temples as if screwed together; stitches in temples, mostly right, from within outward; semilateral headache; shattered or concussed feeling at every step; pressing headache on vertex, worse from 4 to 8 p. m., from stooping, lying down, and exerting the mind; followed by great weakness; awakes with violent headache and throbbing on top of head; headache as if brain was oscillating to and fro, especially when walking, going up stairs, or rising from stooping; headache especially in the afternoon and at night, characterized by a disposition to faint and great restlessness. Headache worse from warm bed, getting warm while walking, and from mental exertion, or chagrin; better lying down, in open cold air, and uncovering the head. Adapted to gastric, bilious, and rheumatic headaches.

Magnesia phos.—The pains are usually of a shooting character, like lightning; they readily change their position and are somewhat relieved by warmth and pressure; attacks of severe headaches, particularly after childbirth, and at irregular periods; sudden flashes of pain in the back part of the head and neck, spreading all over the head, involving eyes, with sudden flashes of pain like lightning through head; better from hard pressure, rest, and darkness; frequent nausea; cramping pain in abdomen and calves; occasionally flying pains in limbs; drowsy feeling of eyelids; after attacks, dullness of head and intellect; forgetfulness; irritation. Neuralgic or rheumatic headaches; better from external applications of warmth; tending to spasmodic symptoms; shooting, stinging, stupefying, intermittent, or paroxysmal pains; sparks before the eyes; diplopia. A dose of magnesia phos. will often quiet down the excruciating headaches of fever like a charm.

Mercurius.—Pressive, tensive, tearing pains in forehead, as if bandaged in a hoop, worse at night in bed, better after rising or when laying the hand upon it; pressure in forehead and bone below eyebrow, even to the touch; burning in the head, especially in left temple; tearing, drawing pains in head, having their seat in periosteum and in bones of face; headache, as if just beneath the scalp, as if it were too heavy and tight on the brain; stitches through the whole head; violent aggravation at night by the warmth of the bed; also from contact with hot and cold things; congestion to head; head feels as if it would burst, with fullness of brain, as if constricted by a band; head feels as if it were in a vise; with nausea; worse in open air; worse from sleeping, eating, and drinking; better in room; dull and stupid feeling with dizziness; constant rotary motion of head, even when lying on pillow; vertigo as if in a swing; after stooping or lying on the back; sweat profuse, especially at night, but without relief from pain. Especially indicated in catarrhal, rheumatic, or syphilitic headache.

Natrum mur.—Sharp, stitching pain about the head, and sore bruised feeling about the eyeballs, especially when the eyes are moved; headache worse from use of the mind; headache in the morning on awakening; throbbing, mostly in the forehead, as if many little hammers were beating in the head, worse from mental work; pain so severe at times as to make the patient almost maniacal; pressive pain in the forehead and eyeballs so violent that the lids can only be raised with exertion and pain; they can no longer read; when coughing it seems as if the forehead would burst; headache in forehead during and after sneezing, as from a blow, worse from coughing; on awakening in the morning, throbbing and weight; face flushed; shooting from the forehead to the occiput, then in a minute the reverse; headache in vertex and occiput like a weight, worse in the evening, relieved by pressure; with heat of face; dull stupefying headache commencing in the morning after waking, lasting till noon, or going off with the sun; headache from sunrise to sunset; worse from light and at noon; periodic vertigo, with nausea and eructations; headache sometimes as if a cold wind were flowing through the head; constant chilliness. With a natrum mur. headache the tongue is dry and almost clings to the roof of the mouth, although it may look moist when put out; there is great thirst, and the pulse is almost always intermittent. Adapted to catarrhal and malarial headaches, and especially useful in the headaches of school children.

Nitric acid.—Head sensitive to rattling of wagons over paved streets or from stepping hard; congestion to head with heat; painful sensation of fullness; sensation as if the head was in a vise, from ear to ear over vertex; as if someone was forcibly pressing the head; as if the head was tightly bound up; painful tension within the head extending to the eyes, with nausea, violent throbbing, hammering on left side of the head, coming on gradually toward morning and going off about breakfast time; head very sensitive even to pressure of the hat; pain in the skull, with sensation as if constricted by a tape; profuse falling out of the hair, particularly on the top of the head; single, burning moist sores on the scalp; headache in the morning, better after rising; aggravated by motion and succussion and from noise; better from lying down and from riding in a carriage. Called for especially in arthritic, toxic, and syphilitic headaches, and for nervous, irritable headaches, especially after the abuse of mercury.

Nux vom.—Headache situated either in the occiput or over one or the other eye, usually the left; begins usually in the morning, and increases all day until night, and is accompanied generally by a sour taste in the mouth, by accumulation of flatus, and by violent *retching*, often more or less ineffectual, indicating an irritated condition of the stomach; headache in the morning as if he had not slept at night; heaviness in head; headache in middle of brain on awakening in the morning; felt even before opening the eyes; stunning or stupefying headache in morning after eating and in sunshine; head feels as if it would split open, and scalp is sore to touch; pressure on the head with hands relieves the pain; bruised sensation of the brain, generally right-sided; better lying on painless side; pressive headache over left eye, and pain in bones as if it had received a bruise; violent jerking, or dull stitches in left hemisphere of brain, extending from orbit toward parietal bone and occiput, soon after eating; semilateral headache as if from the pressing of a nail in the brain; from excessive use of coffee; pressing as if something heavy were sinking down into the head; pressing headache as if the skull were pressed asunder; pressive headache in the occiput in the morning, immediately after rising; stupefying headache in the morning, aggravated by mental exertion; cannot keep from falling asleep in the evening while sitting, hours before bedtime, but awakes about 3 or 4 a. m., and remains wakeful, with a multitude of ideas crowding in his mind, and just at daybreak falls asleep, filled with busy dreams, from which he rises tired and indisposed to rise; sick headache brought on by wine, coffee, close mental application, and sedentary habits, commencing in the morning, increasing through the day, growing milder in the evening; with dimness of vision, sour, bitter vomiting, constipation; worse from noise, light, in the open air, after eating; pressive headache in the occiput, in the morning after rising; pressed outward from both sides as if the skull were forced asunder, with heat in the brain, momentarily relieved by pressure of the hands; intense headache, with dizziness, pains in the eyes, and derangement of the stomach; the pains which come on by keeping one's self confined in a room are relieved by a walk in the open air, and *vice versa;* headache of men of sedentary habits accustomed to great mental exertion; pressure in frontal region and temples; appearing early in the morning on awakening; impaired digestion, constipation, despondency; catarrhal headaches with heat in face, chilliness, acrid discharge from the nose, which feels obstructed; irritable, angry disposition, inclined to find fault and scold; oversensitiveness to impressions upon the senses; noises, smell, a slight current of air, music, and the most trifling symptoms are unbearable; cannot bear reading or conversation; irritable, and wishes to be alone; face usually pale and distressed, or a sickly, sallow expression; a numb, tingling sensation in the limbs; limbs weak and trembling; bad taste in the mouth; tongue heavily coated white, yellow, or first half of tongue clear, sometimes red and shining, posterior covered with deep fur; bowels constipated, with ineffectual and frequent urging to stool, with a sensation as if the anus were contracted; stools very hard and dry, and for some time after a sticking pain in the rectum as from hemorrhoids. Especially useful in headaches caused by constipation, overeating, high living, abuse of coffee, excessive mental labor. Headache from chagrin or anger. The general headache of nux vom. is that of men who eat too much and drink to excess—the headache of a debauch, alias " good time."

Nux moschata.—A feeling of looseness of the brain on moving the head or on walking, worse during hot weather; headache from overloading the stomach, the distress appearing while the patient is eating; feeling as if the food formed hard lumps, with soreness in the stomach; bloating of the abdomen. Congestive headache, the pain seeming to be just under the bone; pain over the left eye, constrictive, burning, stinging, with redness of the face, difficulty in speaking, and unconsciousness when the attacks are violent. This remedy is especially useful in hysterical females who are subject to fainting spells from slight causes.

Opium.—A sensitive pressure about the right frontal eminence, with a sensation of heat while reading; when this disappeared it gave place to a painful, pinching sensation in the right temple, as if something pressed upon the part and then again relaxed; throbbing of the arteries; rush of blood to the head, with a sensation as if the brain were constricted; a stupefying pain, attended with dizziness; tendency to sopor and obscuration of sight; sensation in the head like that following sleep after excessive debauch; sensation as if he were flying or hovering in the air; fainting turns with vertigo whenever he attempts to rise from bed, with sudden return of animation upon lying down; great heaviness of head, making thought and writing difficult; very sleepy, but cannot go to sleep; red, bloated, swollen face; eyes red, glistening, and prominent. It is indicated in congestive, nervous, and reflex headaches.

Phosphoric acid.—Violent pressure in the forehead, in the morning on awakening, with stupid feeling and inability to open the eyes; dreadful pain on top of the head, as though the brain were crushed; occipital headache and pain in nape of the neck, from exhausted nerve-power or excessive grief; pressure as from a weight in the head from above downward; headache usually goes from behind forward, and is relieved by lying down; headache forces one to lie down, and is unsupportable; aggravated from the least shaking or noise, especially music; dullness of the whole head, inability to think; confusion and painful cloudiness of the head; schoolgirls' headache; the headache comes on when they study, and continues as long as they study. Pressive pain with anæmic condition is the keynote of phosphoric acid. Anæmic headaches.

Paris quad.—The headache peculiar to paris quad. is of spinal origin, arising from the nape of the neck and producing a feeling as though the head were immensely large; pains as if the eyes were *drawn back by strings;* the eyeballs feel too large. Constrictive pressure in the forehead and temples; brain, eyes, and skin feel tense, and bones feel as if scraped; worse from motion, excitement, or using the eyes; sticking pain in the middle of the head and in the temples; afterward a heavy pressure upon the forehead, especially on stooping; the scalp is sensitive to the touch, with sore pains in small spots on the forehead; sense of weight and weariness in the nape of the neck and across the shoulders.

Petroleum.—Heaviness like lead in the occiput; pressure, and stiffening pressure in occiput, in morning; pinching or dull pulsating pain in occiput; circumscribed pain in occiput, worse on shaking head; pain from occiput over head to forehead and eyes, with transitory blindness; gets stiff, loses consciousness; occipital headache extending to the vertex, with vertigo, stiffness of neck, swelling of muscles; rapid motion of the head seems to relieve the pain; vertigo in occiput, with general feeling of numbness, stiffness, and nausea; neuralgic headache beginning in the occiput and extending forward; attack commences in the occiput, then spreads to the front of the head, and as it reaches its climax the occiput is free.

Phellandrium.—Pain as from a weight on the top of the head, with aching and burning in the temples and above the eyes, which are congested; eyes water; can bear neither light nor sound.

Platina.—The headaches are of a constrictive character; a squeezing, cramp-like pain, with numbness, and the pains gradually increase and decrease; numbness in forehead as if constricted; pain worse in a warm, crowded room, soon increasing to a dull, burrowing compression, with fretful impatience and heat in upper part of body, especially in head; sensation of numbness on head and externally on vertex; preceded by a sensation of contraction of brain and scalp; worse in the evening and while sitting; better from motion and in open air; violent, cramping pains, especially over root of the nose, with heat and redness of face, restlessness, whining mood, roaring in head as of water, with coldness of ears, eyes, and one side of the face; cramp-like, drawing constriction in the head from time to time, especially about the forehead; neuralgic headache in sensitive or hysterical persons; cramp-like pressing inward, with hot and red face, and roaring in head; headache gradually increasing till very severe, and then decreasing as gradually; vertigo, especially on sitting down or going downstairs. Headaches worse from resting in a warm room, from stooping; better from motion and being in the fresh air. Especially useful in neuralgic or nervous headaches from anger or chagrin, and in reflex headaches from uterine disease.

Plumbum.—Heaviness in the head, especially in the cerebellum; violent, pressive frontal headache, aggravated by mental labor; sensation as if a ball were rising from the throat into the brain; sick headache, with pain in the occiput, umbilical colic and bilious vomiting; yellow skin, especially of the face; chronic, dull headaches with depressed spirits and constipation; violent pains in the integument of the skull, from occiput to forehead; vertigo on stooping, when looking upward, better in the open air; dimness of vision or sudden loss of sight and deafness, complicating motor palsy in some cases; headache from Bright's disease, or from organic disease of the brain or spinal cord. Neuralgic headache.

Podophyllum.—Stunning headache through the temples, better from pressure; pressing in the temples in the forenoon, with drawing in the eyes as if strabismus would follow; momentary darts of pain in the forehead, obliging one to shut the eyes; throbbing temples, aching eyes, hot head, in morning; burning pain on top of head and over forehead; attack lasts twenty-four hours, and, if very severe, ends in vomiting; urine pale during the attack; passes much bile the day after; mist before the eyes, then fleeting pains, worse at the occipital protuberances, down neck and shoulders; morning headache, flushed face; headache alternating with diarrhea; sick headache, accompanied by constipation. Headache worse in the morning; better from pressure; from sleep; from lying down in quiet and dark place. Especially useful in bilious and rheumatic headaches, based on torpidity of the liver.

Psorinum.—Headache preceded by flickering before the eyes; by dimness of sight or spots; by objects dancing before the eyes, and by black spots or rings; pain as if the brain had not room enough in the forehead, when rising in the morning, a boring outward; better after washing and eating; pain like hammers striking the head from within outward; wakens at night as from a heavy blow on the forehead; pressing headache in small spots in forehead and temples; morning headache, with pressing in forehead; stupefaction, staggering; feels as if intoxicated; eyes feel sore; chronic headache, associated with an inordinate appetite; sensation in the occiput as of a piece of wood lying on the head; head sensitive to the air, even in hot weather; humid eruption on the scalp, the hair becomes matted and of a foul odor. When the well chosen remedy does not act, psorinum may prove useful, though not often indicated.

Pulsatilla.—Headache chiefly in forehead and supraorbital region, and in temples; pains heavy, bursting, and throbbing; worse from mental exertion, stooping, and in evening; pressive pain in forehead, above the orbits, involving the whole head; headache extending into the eyes so that they ache in the evening; heaviness of the head; cannot hold it upright or raise it; in stooping it seems as if head were too heavy; dullness of the head, like a bruised sensation in forehead; with aching eyes; especially pressive in the forehead; twitching, tearing pain in the temple lain upon, goes to the other side when turning on it; worse evenings and on raising the eyes upward; one-sided headache, as if the brain would burst and the eyes fall out of the head; headache as if one had eaten too much or as if the stomach had been overloaded by too much fat meat; throbbing pressive headache, better from external pressure; stitches in one side of the head, generally in one temple or in the back part of the head, with vertigo, ringing in the ears and vanishing of sight; violent pain in one side of the occiput as if a nail were driven in; semilateral headache, with bad taste in the mouth in the morning, without thirst, with nightly diarrhea, and scanty urination; vertigo, worse sitting or lying, better from walking, and in the open air; headache caused by indigestion and in consequence of scanty menses; heat in head; ringing in ears during attack; pain in small of back; dullness, lassitude, chilliness; restlessness, sleeplessness, sleepless nights and in women a profuse milky leucorrhœa, with palpitation of the heart on the least exertion. Rheumatic headache, worse on one side, and from 5 to 10 p. m., with excruciating pains in the face and teeth. Sick headache from suppression of the menses (in women who are inclined to be fleshy, with scanty menstruation), or menstrual and gastric disorders. Headache from excessive study, abuse of coffee or spirits, or rich fat food, or abuse of quinine, iron, sulphur, or mercury. Headache worse in the evening after lying down, aggravated by lifting the eyes, during rest and when sitting, in a close warm room, in the cold and from wet; better in the open air and from compression. Pulsatilla acts pre-eminently upon the vegetable system, upon the organs of reproduction and their appendages, and upon the composition of the blood, depressing the action of the former systems and producing in the latter a condition similar to that of one form of chlorosis. We learn these facts by bringing a knowledge of physiology to bear upon and interpret the symptoms of the intestinal tracts, of the urino-genital organs, those of the vascular system, and the symptoms of the head and the disposition. For in these we have retarded digestion, vertigo, audible pulsation of the carotids, momentary loss of sight and hearing on sudden exertion, palpitation, paleness, retarded and scanty menstruation, with syncope and exhaustion; also a depressed melancholic disposition. The concomitants are heaviness in head on stooping, paleness and internal heat in the head, absence of thirst, chilliness, cold feet, wakefulness in the evening and sleepiness in the morning, etc. Vertigo of pulsatilla, staggering; it occurs after eating, in a warm room, and during repose. Every drug affects some organ or system of organs or tissues more decidedly than others.

Rhododendron.—Violent tearing and drawing in bones, and in periosteum of cranial bones; headache like a tearing of the bones of the skull, worse in wet, cold weather, relieved by warm wraps and from moving about. Rheumatic headache, especially in the periosteum of the bones, involving the forehead and temples, resulting from cold, stormy weather.

Rhus tox.—Stitches in head extending to ears, root of nose, and malar bones, with toothache; head so heavy that she was obliged to hold it upright to relieve the weight pressing forward into the head; scalp sensitive, worse on side not lain on, from growing warm in bed, from touch, and from combing the hair back; headache immediately after a meal; desire to be quiet and to lie down; the pains are excited again by the least chagrin or by walking in the open air; periodical attacks of headache; pain beginning in the occiput, extending to the vertex and then to the forehead; pains worse in middle of afternoon, better by walking rapidly in the open air; headache in occiput, better by bending the head backward; occipital headache, muscles sore, better from moving and from warmth; violent tearing and drawing pains in periosteum of cranial bones; worse at rest and in damp, cold, stormy weather; better from wrapping head up warmly, from dry heat and exercise; on shaking the head the brain feels as if it were loose and struck against the skull. There is always a restlessness with the pains and the pains are greatly aggravated by rest; worse after midnight, before storms, or following cold or damp weather; relieved by motion. Adapted especially to rheumatic headaches.

Ranunculus bulb.—Headache over right eye; worse lying down, better walking and standing; pressive headache in vertex and in forehead, as if pressed asunder, with pressure on eyeballs and sleepiness; better in evening or in going from a cold to a warm room or *vice versa;* congestion of blood to the head, sensation of fullness and enlargement of head; vertigo, with danger of falling when going from the room to the open air; headache with nausea and sleepiness. Headache is caused by or aggravated by change of temperature.

Sanguinaria can.—Headache with nausea and chilliness, followed by flushes of heat extending from head to stomach; congestion of blood to head, with ringing in ears, flushes of heat, accumulation of water in mouth; sick headache, with particular aversion to odors; headache that seems to come from the back of the head and settle over the eyes, particularly the right eye; neuralgia in and over right eye; the head aches as if it would burst, better walking in open air, worse in temples, especially in right one in afternoon; headache begins in occiput at sunrise and spreads upward and settles over right eye; with nausea and vomiting, has to be in the dark and lie perfectly still; can bear neither sound nor odors; flashes of heat; burning of soles of feet; urine at first scanty, but later profuse and clear; the pains are of a sharp lancinating character and at times throbbing; better from firm pressure and from sleep; pain in back part of head running in rays upward from the neck; pains like a flash of lightning in the back part of the head; severe headache only relieved by pressing the head back against something hard, or by pressing back of head; headache concentrating in a small spot over the right eye; eye becomes red and sore, yet hard pressure upon eye relieves it; periodical sick headache, the pains begin in the morning and increase during the day and last until evening; head feels as if it would burst or as if the eye must be pressed out; throbbing, lancinating pains in the brain; worse at the right side; especially in the forehead and vertex, followed by chills, nausea, and vomiting of food or bile; must lie down and keep perfectly quiet in a dark room; relieved by sleep; the attacks occur paroxysmally, one week or longer; intermittent neuralgia coming in the morning and lasting several hours; pain at the internal, superior angle of the right orbit; acute pressing with occasional darts from without inward, and throbbing, burning, and watering of the eyes; rheumatic pains in the nape of the neck, shoulders, and arms; parts sore but relieved by pressure; head feels dizzy, cannot turn quickly without fear of falling; vertigo, with nausea and headache, with spasmodic vomiting. Headache aggravated by noise, light, motion, and from touch; better walking in the open air, from darkness and quiet and from sleep. Sanguinaria has no equal in sick headache, especially in that form which is so common in this country as to receive the name of " American Sick-headache "; gastric; also in nervous, rheumatic, and catarrhal headaches.

Sepia.—Pressing or bursting headache as if the eyes would fall out, or head burst, worse from stooping, motion, coughing, or shaking the head; continued hard motion relieves the headache; pains shooting from forehead to vertex on both sides of face; pains over one eye (it may be either) of a throbbing character; deep, stitching pains, which seem to be in the membranes of the brain, and these pains almost always shoot upward, or from *within outward;* can bear neither light, noise, nor motion; boring headache from within outward, forenoon till evening, feels as if he would die; worse from motion and from stooping; better by rest when closing the eyes, from external pressure and sufficient sleep; heavy pressing pain in left orbit and left side of the head or forehead, with darting pains from left eye over side of head toward occiput, better after meals; paroxysms of hemicrania, stinging pains from within outward, mostly in left side of head and in forehead, with nausea and vomiting and contraction of pupils, worse indoors and when walking fast, better in open air and when lying on painful side; sore pain in left eye and temple; throbbing, tearing, and stitching pains in left temple, extending downward to teeth; hair of head sensitive to touch; pains in paroxysms, with fainting; shivering; coldness of feet; transient heat; thirst; anxiety and despondency; stitching, boring, hammering headache over right eye or in one temple, of such severity as to make her scream, with nausea and vomiting, better from sleep and darkness; drawing, tearing pains, and now and then stitches as if from needles, worse morning and evening; severe pressure in occiput, with heat and redness of face; eyes painful; lassitude and tiredness of limbs; inclination to cry; is not disposed to do anything; pulsating headache in cerebellum, beginning in morning and lasting till noon, or sometimes till evening, worse from least motion, when turning eyes, when lying on back, better when lying on side, when closing eyes, when at rest, and in a dark room; *headache in terrific shocks;* headache with aversion to all foods, a feeling of emptiness and goneness in pit of stomach, very distressing; headache occurring every morning, with nausea and vertigo; epistaxis in women of sallow complexion, or face puffed, pale, dirty yellow, in morning red in evening pale; yellow saddle above upper part of cheek and nose, and yellow spots on face; between the menses a peculiar sweet-smelling sweat, particularly in axillæ and about soles of feet; menses scanty and of too short duration; leucorrhœa between menses; great prostration; vertigo as if intoxicated; vertigo when walking as if every object was in motion; as if suspended in air; stupefaction of head; mental confusion, can scarcely think; tension in forehead and pressure as from a weight over eyes; pressure and burning in eyes. One great characteristic of sepia is an aggravation of the headache from the slightest impression on the special senses, as light, noise, odors, etc. Sensitiveness of roots of the hair to contact, to cold wind; worse in evening, when lying on painless side; burning after scratching. Headache worse indoors, from motion, even turning the eyes, toward evening, in the morning, and lying on the painless side; better in open air, when lying on painful side, from rest, closing eyes, in dark room, after meals, and from sleep. The sepia patient is delicate and depressed, and the symptoms are of physical relaxation; a depraved appetite, dyspepsia, and a bad complexion. Indicated in gastric, rheumatic, and nervous headaches, but more especially in that form of reflex headache due to menstrual disorders.

Silica.—Congestion to head; cheeks hot; burning in soles of feet. The headache is usually supraorbital and generally worse over the right eye; worse from noise, motion, or concussion; better from wrapping the head up warmly; headache or cold feeling rising from nape of neck to vertex; headache involving nape of neck, vertex, occiput, and eyes; when most violent, accompanied by nausea and vomiting; passing away during sleep; severe pressing or shattering headache; the pain is felt in the nape of neck, ascends to vertex, and then to supraorbital region; also from occiput to eyeball, especially right; sharp darting pains and steady ache, eyeball being sore and painful when revolving; worse from noise, motion, jarring of the room from a footstep, and from light; relief from heat, but not from pressure; head sore to touch externally; sensibility of pericranium; scalp sensitive to pressure of hat, and to contact; cannot brush the hair, the scalp is so tender; itching spots on head; painful, as if sore after scratching; tendency to take cold in head which cannot be uncovered; head wet from sweating, particularly at night; profuse, offensive-smelling foot sweat; sweat sour; face pale, emaciated; large abdomen; lassitude; loss of appetite, or a canine hunger; vertigo, as if one would fall forward; vertigo ascending from dorsal region through nape of neck into head, worse from motion or looking upward, accompanied by nausea; headache followed by temporary blindness. Headache worse from mental exertion; excessive study; noise; light; motion; cold air and touch; better from wrapping head up warmly; hot compresses; in warm room and lying down in the dark. It is especially useful in persons who are oversensitive and imperfectly nourished, not from want of food, but from imperfect assimilation. Silica is adapted to gastric, congestive, nervous, and rheumatic headaches.

Spigelia.—The spigelia sick headache is very apt to follow the sun, beginning in the morning, reaching its acme at noon, and gradually subsiding at sunset; the symptoms appearing even in cloudy weather and the headache being termed "sun headache." The pains are situated in various parts of the head, and may be either on the right or left side; pains may be pressing, shooting, stitching, boring, or tearing in character. The characteristic headaches of spigelia are of a *neuralgic* nature; headaches commencing in the morning in the nape of the neck or in the occiput, the pain spreading up and over the left side of the head causing violent and pulsating pains in the left temple and finally settling over the left eye; the headache increasing in severity until noon, and then gradually decreases until evening, when it disappears; burning, jerking, tearing pains, worse from noise, any jarring of the body, and from a change of weather, especially in stormy weather; at the height of the pain there is usually bilious vomiting; headache especially on left side, extending to eyes, zygoma, and teeth; great sensitiveness to wind; worse from stooping, from motion, and fresh air; better from pressing the head hard with hand, from lying with head high, or from washing head; periodical headaches, beginning in the morning, in the cerebellum, spreading over left side of head, causing violent and pulsating pains in left temple and left eye; painfulness of cerebellum with stiff neck; headache when stooping, as from a band around the head, and quick movements convert the *dull, heavy* pains into *acute, stabbing* pains; when moving facial muscles, sensation as if the skull would split; sensation as if the head were open along the vertex. Nervous headache, worse from thinking, from noise or jarring; face pale; anxious; palpitation; nausea and vomiting. Neuralgia—this may be in either eye, more frequently, however, in the left; the pains center in, above, and below the eye, and are of a sharp, stabbing nature; the supraorbital region is sensitive to touch; the eyeballs feel swollen, as if too large for the orbit, and associated with these symptoms are lachrymation and coryza. Supraorbital neuralgia, especially on left side; pain recurs at regular intervals, tends to spread to face or neck, and involves eyes; worse from least concussion or motion, but especially from stooping; pale face, restlessness; palpitation. Migraine, affecting either supraorbital region, during cold, damp, rainy weather; severe throbbing, tearing, or stitching pains, with redness and lachrymation of eye of affected side; a feeling that the eyeballs are too large; vertigo while sitting, stooping, standing, or walking; vertigo when looking down or turning eyes, with nausea; shaking in brain, worse when moving head or stepping hard; scalp sore to touch. Headache aggravated from thinking, by a bright light, by noise, by motion of eyes, by stooping, by making a misstep, by touch, by warmth, and especially severe after or on lying down; relieved when lying with head high, or walking about the room for a long time, and in the evening; headache coming on several times a week. Headache of schoolgirls; headache beginning in the morning, and becoming so severe as to cause the patients to desist from their studies; such cases are usually somewhat anæmic, and have the characteristic dragging pain of anæmia back of the eyes. Adapted to nervous and rheumatic headaches.

Stannum.—The headache of stannum is characterized by the gradual increase of pain until it reaches its acme, and then an equally gradual decline. Pressure in left temple, beginning slight, then increasing, and so again diminishing as if forehead would be pressed inward; painful jerking through left temple, forehead, and cerebellum, leaving a dull pressure; worse during rest, better from motion; headache every morning, over one or other eye, mostly the left, gradually extending over whole head and forehead, increasing and decreasing gradually; often with vomiting; vertigo worse when walking in open air or raising head; profound prostration of whole nervous system. Headache worse during rest, when walking in the open air; better from motion. Nervous, neuralgic, and catarrhal headaches.

Staphisagria.—Staphisagria has a headache which is sometimes met with, though not frequently. There is a sensation as if the forehead would burst on stooping, and a sensation as if the brain were being squeezed; worse on moving the head; a sensation as of a round ball in the forehead is also characteristic; a hollow feeling in occiput; a feeling as if the occiput were compressed internally and externally.

Stillingia.—Dull, heavy, stupefying pains in the frontal region; dizziness, with throbbing in the head; headache accompanied with influenza, and watery eyes, and general soreness of the muscles; violent frontal headache, with stinging, darting pains in the face; stupid headache through the temples, with slight nausea and coated tongue. Especially useful in syphilitic and catarrhal headaches.

Stramonium.—Congestion to the head, with beating of the carotids, sparkling eyes, pulsating in vertex, loss of sight and hearing, and a bloated, turgid face; head hot, also the whole body; congestive headache in the morning, increases until about noon, when it begins to decline, and toward evening passes off entirely, but returns next morning; boring, frontal headache, preceded by obscure visions; headache from being exposed to the sun, and following sunstroke. Rheumatic headache, with dullness and difficulty of thinking, worse on vertex or forehead, in evening and at night. Congestive, nervous, hysterical, or rheumatic headaches.

Sulphur.—Heat on crown of head; cold feet; frequent flushing; rush of blood to the head; a pressure out at the eyes, with roaring in the ears, and heat of the face; worse when stooping, talking, in the open air, and sitting in a warm room; tearing or stitches in forehead or temples, from within outward; worse from eating or from stooping; better when pressing head, or when moving about; pressure in forehead and temples, or tight feeling in brain when thinking or doing mental work; pressive headache in forehead, worse on motion, with great restlessness; headache is attended by nausea; hair falls out; forehead is covered with acne; sensitiveness of vertex, pressing pain when touched; worse in evening, from heat of bed, in morning when awakening; smarting and burning after scratching; sensation of emptiness in occiput; worse in open air and from talking; better indoors; nocturnal headache, worse from least motion in bed; heaviness in head, particularly in occiput; pains in head as if the head would burst; stitching, hammering in head; throbbing pain in vertex; a cold spot on head; sensation as if top of head were being pressed against the wall, with heat in whole head; headache in women where the menses are too early, too profuse, last too long; blood black, thick, and acrid; headache from abdominal plethora; from suppressed skin disease. Headache worse from heat of bed, from wet, cold weather, open air; better from warm room, when moving, and from pressing the head. Congestive, catarrhal, rheumatic, and gouty headaches.

Theridion.—Violent frontal headache, with heavy, dull pressure behind the eyes; with throbbing, extending into the occiput; heavy pressure on head, pressing downward; headache deep in sockets of the eyes, worse in left eye; head feels thick, as if it were another strange head, or as if it had something upon it; that she can lift it off; throbbing over left eye and across the forehead; sick at stomach; worse from lying; on rising; from pressure; walking over the floor; from least noise; sharp neuralgic pains over left eye, with weakness, trembling, coldness, and anxiety; very severe headache, with nausea and vomiting, like seasickness, and with chills; headache like a pressing band in root of nose and over and around the ears; vertigo and nausea, worse when the eyes are closed, from motion and from noise; every sound penetrates the teeth; every penetrating sound and reverberation penetrates the whole body; great hypersensitiveness (keynote); sensitive to light; flickering before eyes in frequent paroxysms, even when closing the eyes; things look double; weakness, trembling, coldness, and anxiety; anxiety about the heart and weakness with sharp pains through the left chest; or to the left shoulder; faint after every exertion; sick at stomach as soon as eyes are closed, with vanishing of thoughts; headache from seasickness. Nervous, neuralgic, and reflex headaches.

Thuja.—Violent headache, especially at night; tearing in forehead, temples, and occiput; sensation in right parietal bone and left frontal eminence, as if a nail were driven in; disappears on pressure; drawing, stitching pain in right temporal muscle, aggravated by mastication, relieved by contact; headache on left side as if a convex button were pressed on the part; the pains involve the left side chiefly, and seem to extend in rays upward and backward; the pains are of an intense stabbing character, almost unbearable; worse from sitting; better lying down; pains commence about forehead and eyes, and extend upward and backward with a cold feeling in the eye, as though a stream of cold air were blowing on it; intense pain, as though a nail were being driven into the forehead or vertex; scalp sensitive to touch or pressure on pillow; better if rubbed; white, scaly dandruff; hair dry and falling out; vertigo with eyes shut, better when opening them. Headache worse in evening, in warm bed, from touch, and from 3 to 4 a. m.; better on motion, and from rubbing. Especially useful in nervous, toxic, or syphilitic headaches.

Valeriana.—Headache appearing suddenly as in jerks; pressing as from a stupefying constriction in forehead; drawing into orbits; face pale; worse evenings, at rest, and in the open air; better from movement, in room, and from changing position; violent pressure in forehead, followed in a few minutes by sticking in forehead, and especially in orbits; soon stitching changes into pressure, and so on in constant alternation; stitching is like a darting or tearing, or as if it would pierce the eyes from within outward; sensation in head as of great coldness; sensation of icy coldness in vertex when pressing firmly with hand, or when covering it with hat; vertigo when stooping; vertigo with a sensation as if flying in air; frequent flashes of light before the eyes. Nervous headache, in which the hysterical element predominates.

Veratrum album.—Pressing, throbbing, nervous headache, affecting one side, with stiffness of neck and sensation as if head would burst; head hot and covered with sweat; nausea and vomiting; frequent and profuse micturition; face pale; fainting, with cold sweat and great thirst; neuralgic headache, especially characterized by a feeling of ice on the vertex; neuralgia in the head and convulsive shocks immediately on raising the head, with vomiting; better from pressure on the vertex; persistent vertigo, with cold sweat on the forehead, with great weakness. Especially useful in the nervous headaches of young girls and hysterical women, with pale, earthy countenances, and nausea and vomiting; also people who are habitually cold and deficient in vital reaction.

Viburnum opulus.—Dull, heavy headache, mostly over the eyes, worse on the left side, at times extending to the vertex and occiput, particularly when delayed menses should have appeared; worse from sudden jar, bending over, false step or movement; dull, throbbing, frontal headache, extending to the eyeballs, aggravated by mental exertion and relieved by moving about; headache, accompanying cramp-like dysmenorrhea. This is an excellent remedy in those forms of headache which are associated with menstrual derangements such as delayed menstruation, dysmenorrhea, etc., where there are severe, cramping, colicky pains in the abdomen, coming suddenly and extending around the pelvis to the uterine region, with sensation of emptiness and goneness, and the pains sometimes extending down the thigh; also cramps in the calves, always between the menses, worse just before the period, with scanty, delayed menstruation or with dysmenorrhea.

Zincum.—Stinging, tearing headache, worse in the side of the head, worse after dinner, greatly increased by wine or anything that stimulates; pressure on root of nose as if it would be pressed into the head; pressure on top of head and forehead, gradually increasing after dinner; sharp pressure in small spot in forehead of evenings; cramplike and tearing pains in right and left temple; pressing, tearing pains in the occiput, particularly about the base of the brain; pains seem to shoot through the eyes, and sympathetically into the teeth; obstinate pain in the head, obstinate in its resistance, yet intermittent in its quality, now very severe and now fading away, but continually returning; sensation of soreness of vertex, as from ulceration; worse in evening, in bed, and after eating; better after scratching; frequent attacks of vertigo, preceded by pressure at the root of the nose, and a sensation of drawing together of the eyes as from a cord; headache better by washing in cold water, and in open air; worse in warm room, after eating, and from wine. Sick headache, with great weakness of sight, and a fidgety feeling in legs and feet. Useful in anæmic headaches and in nervous headaches due to general nervous debility.

In addition to the indicated remedy, rest and nourishing diet are important adjuncts to the treatment. Irregularity of meals and of time of sleeping must be corrected. Too free use of stimulants, such as coffee, tea, wines, and liquors, must be prohibited. When the headache is the result of overwork of the brain and prolonged study, treatment will prove of little avail unless this is corrected. All causes of nerve-waste must be sought for and removed, if possible. Discharges of all kinds, such as menorrhagia, leucorrhœa, etc., should receive prompt attention. Derangement of the assimilative functions should never be overlooked. Eye-strain is quite frequently a cause of headache, but not so often as is stated by some authors. Some of our recent writers of neurology have claimed that almost everything, from "corns" to "toothache," can be cured by "properly fitted glasses," thereby relieving the eye-strain. It is simply appalling to go into some of our cities and see the number of people wearing glasses, especially if there are a number of eye-specialists in that city. We do not doubt but what a great many people are relieved by wearing glasses; but we do think that in too many instances glasses are fitted when they are not needed. The mistake has been that headaches of a purely reflex origin, from errors of refraction, have not been correctly differentiated from those of a purely idiopathic origin—the migraine group.

We do not believe that a typical case of migraine can be any more benefited by "properly fitted glasses" than by a "properly fitted pair of gloves," unless in that particular case, *coincidently*, there was an error of refraction.

It seems to be the tendency of specialists—not only of eye troubles, but in every line—to attribute every ailment to some cause in their line. We believe in physicians following certain lines of work and fitting themselves in that branch thoroughly, but while doing so they should not forget to look over the broad field for other causes.

Hot applications and penciling with menthol will often give relief. Cloths wrung out of hot water (not simply warm water, but *hot* water) and applied over the seat of the pain (changed every three to five minutes) will often relieve a severe case of neuralgic headache like magic.

In hemicrania of the neuralgic or nervous type electricity will be of great service, often one application relieving the pain. The positive pole should be applied over the supraorbital or temporal region, and the negative pole over the nape of the neck. Hemicrania, attended by a contracted condition of the blood-vessels, and sunken eyes and features, should have the positive current applied through the electrode at the neck. On the contrary, when there is a paralytic condition of the vasomotor nerves, shown by fullness of the blood-vessels and injected eyes, the electrode at the neck should be negative, and the current should be interrupted, or, in some cases, repeatedly reversed by means of a pole-changer. General faradization and central galvanization are both beneficial in many cases where the headache frequently recurs. In headache from reflex irritation, due to disease of some organ, it is best to apply the electricity at the seat of the disease instead of the head exclusively. In the anæmic type of headache the best results would be obtained from *static insulation*. The patient being charged with the positive pole, the electric breeze or spray is applied to the head, especially over the painful area and the region of the cervical sympathetics.

DERANGEMENT OF THE MENTAL FUNCTIONS.

INSANITY—LUNACY.

(*Luna, the Moon.*)

Remarks on Insanity in General.

"The highest study of mankind is man," and it might be added that the most interesting and difficult study of man is his mind. Its study involves all the complex and ever-changing manifestations of the human mind, that great mystery, whose secrets the scalpel of the anatomist has not yet laid bare.

The word "insanity" is a term of great flexibility, and subject to the widest difference of meaning. It has a popular meaning, a medical meaning, and a legal meaning. Insanity may denote any condition of the mind, from the mildest indisposition to the most abject state of idiocy.

Insanity not being a disease, but merely a symptom, and due to many morbid conditions, it would therefore be difficult to frame a short and concise definition that would include all forms of insanity, and at the same time exclude those diseases in which it does not exist. In fact, in a court of law no mental expert will be induced, if he be wise and regardful of his reputation, to give a definition of insanity.

Insanity is that state in which the balance between the emotions, judgment, and reason is lost: or it may be defined as mental inability, without loss of consciousness, to arrive at logical conclusions.

Cruse defines insanity as "A psychic manifestation of brain disease, unattended by loss of consciousness."

Hammond * defines it as "A manifestation of disease of the brain, characterized by general or partial derangement of one or more faculties of the mind, and in which, while consciousness is not abolished, mental freedom is weakened, perverted, and destroyed."

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* A Treatise on Insanity.

Hack Tuke * defines it as: "A disease of the brain (idiopathic or sympathetic) affecting the integrity of the mind, whether marked by intellectual or emotional disorder."

J. Batty Tuke defines it as: "A symptom of various morbid conditions of the brain, the result of defective formation or altered nutrition of its substance; induced by local or general morbid processes, and characterized especially by non-development, obliteration, or perversion of one or more of its psychical functions."

The definition of Savage * is one of the simplest as well as the most comprehensive. He says: "That 'sanity' and 'insanity,' as recognized by the doctor, and, in fact, by the general public, must be but terms of convenience; that a man's sanity is to be gauged purely by what is his general standard; that sanity and insanity, then, are to be measured by differences or changes of habit, taste, and disposition in the individual, as well as by other symptoms of change in the nervous centers."

Often it is difficult for the most expert alienist to decide whether an individual is sane or insane, and then only by close and long-continued observation. There are no well-marked boundaries between sanity and insanity. There is no arbitrary line separating the two states, of which we can say that all individuals on this side are sane, all on that side are insane. Who can say when day ends and night begins? There is an interval between the departing light of day and the approaching gloom of night which can neither be called "day" nor "night," but is termed "dusk." This interval is marked by numberless, varying shades and degrees by which day gradually shades off into night. Just so in regard to the terms "sanity" and "insanity." The one shades off into the other by fine degrees. There is a

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* "Insanity," George H. Savage, M. D., "Dictionary of Psychological Medicine."

period in which the disease is not yet fully developed, where the individual exhibits many of the characteristics of mental soundness, while at the same time giving evidence of mental deterioration; a period, figuratively speaking, that could not be called the daylight of reason nor the night of mental gloom.

That insanity is on the increase there seems to be little doubt. This is a natural consequence of the greater increase of neurotic affections of all kinds. The increase of insanity should awaken in every thoughtful mind the inquiry, "What is the cause of this, and what can we do to save ourselves or our children from the terrible fate which befalls so many of our fellowmen?" As we look about us, we can see many causes why nervous affections of all kinds are on the increase. The demands that are made for the requirements of modern civilization are greater; the constantly increasing departure from simple modes of life brings with it desires and emotions formerly unknown. The progress of industry, art, and science necessitates a general increase of the cerebral functions. The range of subjects to be acquired is constantly enlarging; education is begun earlier, and carried on to a more advanced period of life; the unlawful thirst for gain; the irregular life of people in the matter of diet, dress, and, above all, sleep, and various other ways in which the laws of the physical being are ignored, all have their influence. The present state of society keeps up a general, half intoxicated state of cerebral irritation, which is far removed from a natural and healthy condition, and therefore predisposes to insanity. It is, therefore, not surprising that when there is any weakness of the nervous system, when the nutrition of the physical basis of the mind is impaired, certain faculties should be deteriorated or lost, while others are exaggerated, and that there should be some disturbance or even complete overthrow of their proper balance. The proof of modern civilization, with its worries, customs, and restraints, acting as a cause in the production of insanity, is brought out by comparing the statistics of the older and the newer States. We find, by reference to the census of 1880, that there is one insane person to every 297 of the population, and it is a significant fact also that this proportion decreases largely with the newness of the States, until some of the Territories show only one insane person to each 3000 of the population.

Insanity never breaks out suddenly. True, acute mania or melancholia may follow (sometimes in a few hours) a sudden shock of terror, grief, or joy, or any strong and violent emotion; but, as a rule, it is always the culmination of a long train of various nervous manifestations, with which every student and general practitioner should so familiarize his mind that they will be more on the alert to look for and recognize them when met in their daily practice. Thereby many cases of incipient insanity may by the appropriate treatment be checked in its first stage. Unfortunately, too little knowledge of this subject is in general obtained in the ordinary course of medical study. Too often in our colleges this subject is set aside and prominence given to other subjects that are not to be compared with it in importance. When we remember the small importance that has been attached to the study by so many of our colleges, it should bring a blush of shame to the medical profession. When we remember that the teaching of this subject has been practically *nil*, as compared with more than one subject of less importance which medical students have now to study and on which they undergo searching examinations, then we should say that every medical curriculum should be altered and the teaching given to the subject which its importance demands. There seems to be an impression among the general practitioners that insanity is a disease that must be "turned over" to specialists, that it is outside of their domain.

True, the science of medicine has become so wide that for a higher and more accurate knowledge certain branches are specialized; yet it should not be left solely to a specialist. For many reasons it is especially necessary that the general practioner should know more or less of the subject of insanity, for most cases have to be treated at home, for a time at least, by the family physician, and many cases do not need to be sent to an asylum at all, but can be treated outside of them, and it is well so to treat them when possible. If you can treat a case out of an asylum, and he recovers satisfactorily, it is better for you and for him. The patient can resume his work and place in the family and in society and be as if he had never been ill; while, if he had been sent to an asylum, it would have an important influence on his future career as a citizen. There seems to be a superstitious prejudice handed down from one generation to another that if an individual has been ill mentally, forever afterward he is to be looked upon with suspicion and distrust. As an extreme instance of public injustice on the subject, we would cite the following example: A man passes by, and the wise but superstitious " public " says, " Beware of him; he needs watching, for his mother-in-law has been in an asylum." So that the sending of a patient to an asylum is a step which always demands the gravest consideration. The public in general look upon mental impairment as humiliating rather than as one of the many physical evils that afflict humanity.

The question of home or asylum treatment will often depend upon the means of the patient as well as his mental condition. A man with unlimited wealth need scarcely ever be sent to an asylum. Home treatment is especially advised in cases in which there is hope of speedy recovery, as in simple melancholia, insanity following fevers, and more especially in puerperal insanity. In many cases, however, they do not have sufficient means to procure skillful attendants necessary for the nursing and care of the patient, nor to fit up suitable apartments. In other cases, where the tendency to commit suicide is very great, unless you have attendants whom you can thoroughly trust, it is better not to take any chances. Again, where the patient is subject to furious outbreaks of homicidal mania, the asylum is the place for him. It is a self-evident fact that exceedingly dangerous and incurable patients, as a rule, should be sent to the asylum. Home treatment is often impossible from the associations and surroundings aggravating the case; the friends are injudicious; the patient is worried too much by his near relations. In fact, the success of home treatment depends upon the quiet of home. In some cases, even where home treatment has been begun, the strain and responsibility on the relations, attendants, and nurses, especially if the patient is strongly suicidal or homicidal, is so great that you may eventually have to send him to the asylum.

A well-appointed asylum has many points of advantage in its favor. It has all the means necessary for carrying out that which is best for the patient. It has discipline, order, a physician well acquainted with the treatment of such cases, skillful attendants, and suitable work to keep the patient employed, thereby diverting the attention of the patient from himself as much as possible. The eccentric behavior of the patient is concealed from over-officious eyes, and the patient has a far greater amount of freedom than he could possibly have under any other circumstances.

Unfortunately, however, every well-appointed asylum is not what could be called a "well-conducted asylum." Many of them are, in fact, conducted on the principles of a prison; their custom being to treat the patients like paupers and jail-birds; their only object, seemingly, being the necessity for restraint, food, shelter, clothing, and protection, the value of medicine being scarcely recognized.

It is a fact greatly to be regretted that the treatment employed in the great majority of asylums, the world over, is purely expectant. There is no thorough investigation into the causes of the mental discord in each case, no individualization or specialization in the treatment. After the reception and initial diagnosis or classification, the insane are treated *en masse*.

In some asylums the medical treatment consists in the diurnal journey of a medicine-tray containing chloral in the evening and whisky in the morning—the size of the dose being regulated by the attendant. The motto, "Abandon hope all ye who enter here," which was applied to the asylums in olden times, could very appropriately be placed over the doorway of many of the asylums of the present day. As an illustration of the foregoing statement, we would call attention to a recent report from one of our large asylums, containing nearly one thousand patients, where the whole professional care of the entire institution was in the hands of the superintendent and two assistants. The superintendent, of course, had no time to devote to professional work, his time being taken up by the business management of the institution. The professional care of the patients, therefore, devolved entirely upon the two assistant physicians. In such cases, as might be expected, very little medical attention can be given to the patients.

To effect cures as speedily as possible should be a prime consideration by every physician, whether in private practice, in hospitals, or in asylums. To do this effectually there should be a much less number of patients assigned to a physician than is found in nearly all insane asylums, and in every case *individual* treatment must be given to each person. It is almost impossible for one physician to examine minutely over one hundred patients and treat each case individually. To accomplish this object there will have to be a radical change in the principles of treatment as followed by the greater majority of our asylums. They will have to abandon many of the older methods and get in accord with the more modern and approved methods of treating disease. In fact, every asylum should be nothing more nor less than an out-and-out medical hospital, and not a reformatory or prison.

These institutions should be placed under scientific physicians. Too often, however, our asylum physicians are chosen through political influence or on account of having a certain "pull" with the State or asylum authorities, and not from special aptitude for that special branch of disease. Those physicians, each and every one, should be required to furnish evidence not only of a thorough knowledge of medicine in general, but also a special knowledge of insanity and its mode of treatment; also a decided aptitude for their special vocation.

The full value of these suggestions will be appreciated when we remember that an ability on the part of the physician to detect and understand the full significance of the early symptoms of mental derangement, and to apply the proper remedy, would in very many cases result in a rapid cure, if not in preventing the full development of the disease.

Symptoms Common to Many Forms of Insanity.

As has been stated before, insanity never breaks out suddenly. When, however, it apparently comes on suddenly after a severe shock of terror, grief, etc., by a close study of the history preceding the attack you will find many symptoms indicating the gradual approach of the coming storm, and the shock of terror, etc., was merely the culminating act that ushered in the attack. There are many persons with delicately balanced organizations, who only require some single depressing or irritating factor to unbalance their mental faculties.

Insomnia is one of the earlier symptoms of insanity. Among the insane (except in chronic dementia) insomnia is one of the most frequent symptoms. The power of sleeping may not be completely lost, but the patient suffers from terrible dreams so that he awakens tired and unrefreshed; or he slumbers and sleeps uneasily, the sleep being broken by the slightest noise. Headaches are rare among the insane, but brain aches of one kind or another are common. Thus they will complain of an uneasy feeling at the vertex; a feeling that their brain has softened; that the brain is swollen, or that it is shrinking away; a feeling that something has given away; a sensation as if a flood of something hot, like blood, had been poured over the surface of the brain. Headache, when present, is usually described as a dull, aching sensation in the frontal and temporal regions; occasionally in the occipital regions; a heaviness of the head, a feeling as of a band around the head, or a sensation as if it were screwed together. The patient is dull, torpid, and taciturn; he is subject to a feeling of ill humor and discomfort, of oppression and anxiety, of lowness of spirit without adequate cause. The power of the mental faculties is diminished; there is perversion of the natural feelings, aversion and hate toward those formerly loved; irritable and peevish or outward insensibility; becomes reckless, extravagant, and prodigal, careless and negligent of his business. A man formerly indifferent to all religious things suddenly takes to studying the Bible and hymn-book, going to church, etc. For a long time preceding the outbreak of the attack there may be a diminution of the sexual sensations and desires, generally very appreciable to the patient; also sometimes actual impotence.

When these peculiarities are of long standing, they gain for the individual the appellations of being "half-cracked," "crotchety," "a screw loose," "wheels in his head," etc. This preliminary period may last for years without leading to serious developments, and then may gradually pass, without further appreciable cause, into active insanity. Frequently the patient is conscious of the commencement of insanity, and seeks professional advice. The patient describes himself as "altered," as "not the same," as "unnatural," etc. As the disease progresses, in some cases there is an entire absorption of the individual in self; in others, total despair and weariness of life and a calm determination to commit suicide. Everything appears strange to him; he believes that he is pursued, charmed by secret influences; he accuses himself of a variety of serious crimes, depravities, and misdeeds; he becomes cunning and suspicious (these are marked characteristics of many of those affected in mind); he becomes miserly, hoarding up with the greatest care the smallest sums of money; believes he will have to go to the poorhouse. To all that formerly interested him he is now equally indifferent, and he is no longer capable of being affected by any new sentiment; participation and interest, pain and pleasure, love and hate cease. Apathy and indifference to everything beyond the satisfaction of his sensuous requirement succeed—dementia.

In the earlier stages there is often observed a hesitation of speech, great uncertainty in connection of thought, and timidity in judging. The speech is altered from the natural tone and

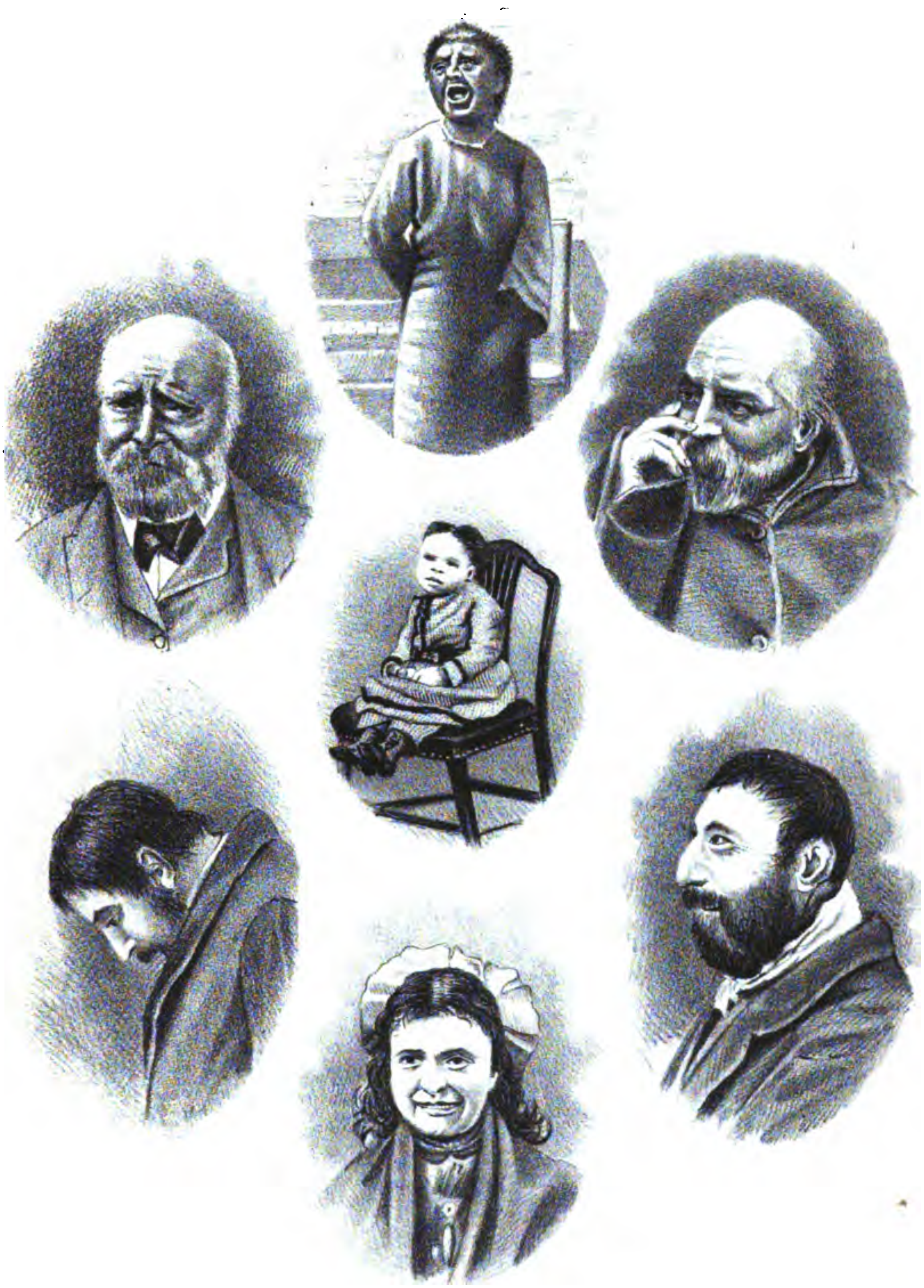

PLATE XVI. SEE REVERSE FOR DESCRIPTION. FIG. 80.

FIG. 80, PLATE XVI.—PORTRAITS OF PATIENTS LABORING UNDER VARIOUS FORMS OF MENTAL DEFECTS AND DISORDERS. (After Hack Tuke).

1.—Acute mania; female patient in the St. Hans Hospital near Copenhagen, photographed by Dr. Pontoppidan.

2.—Chronic mania, with exalted ideas; believed herself to be Princess Beatrice. Photograph of a female patient taken by Dr. Walter P. Turner, at that time assistant medical officer, Kent County Asylum.

3.—Acute melancholia, male patient: Bethlehem Hospital. Never speaks.

4.—Mental stupor. (Melancholia cum stupore.) Bethlehem Hospital.

5.—General paralysis. Dementia. Bethlehem Hospital.

6.—Idiocy. Photographed by Dr. Walter P. Turner.

7.—Sporadic cretinism. Case reported to the International Medical Congress, 1881, by D. Hack Tuke. The patient, a male, had a girlish appearance, and, it will hardly be credited, was thirty-nine years of age when photographed.

style; it is not so distinct as usual, or it is clipped, or hurried, or weak, or too emphatic, prolonged, or drawling. At times he stammers and seems to be at fault in finding the proper word or phrase. Sometimes the speech is lost entirely for a longer or shorter period, not from any paralysis of the organs of speech, but owing to the mind being intensely absorbed or preoccupied in the contemplation of predominant insane ideas. Incoherence is a frequent symptom in the beginning of insanity, and is often significant of a transition to the incurable forms of dementia. In some cases, especially in the commencement of mania, there is often apparently great mental vivacity; an unnatural buoyancy of feeling or levity of manner in contrast to the former disposition. It is more frequent, however, to observe enfeeblement in various modes. Sometimes events happening at the present time are quickly, even instantaneously, forgotten, while there is distant recollection of events that happened in former periods of life.

Sometimes insane subjects are able to describe past events, speak in ancient or modern languages, or repeat long and interesting passages from books, none of which, we are sure, they were capable of recollecting in the natural and healthy state of their mind.

It should constantly be borne in mind that an individual may be insane and yet exhibit no marked derangement of intelligence; the disease manifesting itself rather by senseless actions than by insane thought and speech. The mental derangement being manifested by evil desires, eccentricities, perverseness of every kind—the individual being able to talk "quite rational."

There is one symptom that is common to the insane—namely, attributing to everything, whether trivial or of magnitude, some relation to themselves. This is one of the distinguishing features of *insane ideas.*

During the earlier stages of insanity there is usually disturbance of the digestive tract. The appetite is poor, the patient refuses to eat, either from an inability to fix his attention long enough to eat, or from a belief that the food is poisoned; or he may eat only the food cooked by himself; or he may require others to taste everything before he partakes of it. The tongue is usually furred and the bowels obstinately constipated.

In the later stages the appetite increases, and digestion and assimilation improve. Generally with the cessation of the melancholic or maniacal state there occurs a marked increase in the size of the body—a tendency to become corpulent—and a state of robust physical health. It is considered an unfavorable symptom if the patient gains flesh without a corresponding improvement of his mental condition.

The mental symptoms of insanity may be so prominent as to completely mask the bodily disease. The patient may die of phthisis, bronchitis, or even pleurisy, without cough or pain, however extensive the disturbance may be, the disease being detected only by a physical examination. In every case, therefore, where the patient shows symptoms of illness (loss of appetite, thirst, foul tongue, elevation of temperature, and increased frequency of the pulse), the thoracic organs should be minutely examined. Lobular pneumonia is very frequent, especially in cases where the patient presented during life the symptom of great exhaustion, and it usually runs a very rapid course to a fatal termination.

Griesinger calls attention to the fact that insanity sometimes appears at the commencement or during the earlier stages of phthisis pulmonalis, which is frequently not discovered, the mental overshadowing the physical symptoms; but after the mental disorder has existed for a short time, distinct symptoms of phthisis may be recognized, with which the intellect becomes more free and clearer and the morbid mental symptoms improve or altogether disappear. All of these cases run a rapid and fatal course. Quite frequently lunatics, on the approach of death, regain their mental faculties to a more or less degree.

A symptom met with quite frequently in chronic, slowly progressing cases of insanity is an inequality of the pupils; or again, in other cases the pupils are extremely small—pin-point pupils.

When the temperature rises notably in a case of insanity, it is strongly indicative of an attack of some other disease, or a tendency to fatal exhaustion; in every case the prognosis is unfavorable.

There are four terms that are frequently used when speaking of the insane, with which every student and general practitioner should be familiar—namely, hallucination, illusion, delusion, and lucid interval.

An *hallucination* is a false perception of the senses—that is, sensations are experienced although no external objects act upon the periphery of the sensory nerves. It is an hallucination when they see persons or things that are not present, or hear a voice that has not spoken. Any one or all of the senses may be affected; they may have hallucinations of hearing, sight, taste, smell, and of common sensations. Auditory hallucinations are the most frequent; he hears the voices as well as if they really spoke. The " voices " may speak in a whisper, at a distance, or directly into the ear; they may shout loudly or even scream; they may be heard from above or from below, in the chimney, or under the floor; in many instances the subject of auditory hallucinations carries on a continuous dialogue with imaginary unseen individuals, asks questions, and receives answers. These voices may command him to commit suicide, or to kill certain individuals. Besides voices, various other sounds may be heard, as a buzzing, hammering, whistling, etc. Gustatory hallucinations (metallic taste, etc.) may cause the patient to believe that an attempt is being made to poison him, thereby causing him to refuse his food. Hallucinations of sight may consist of faces or figures in motion. They often appear to him to assume horrible and disgusting expressions, and may render life totally unbearable. Hallucinations of sight and hearing may occur in the blind or deaf. The organs of sense are, in fact, not necessary for the existence of hallucinations. However, an individual born blind or deaf cannot have hallucinations of sight or hearing, for hallucinations of a sense cannot exist unless the individual has at some time or other possessed the use of that sense. The presence of an hallucination does not necessarily indicate insanity. In health he is able to recognize it as such, while in a disease he accepts it as a fact.

An *illusion* is a false interpretation of a sensation actually perceived; or, in other words, a false interpretation of an external object; the person transforms a real object or sound into something else; for example, an individual hearing the moaning of the wind, perceives in this sound the voice of someone calling him.

A *delusion* is a false perception accepted as a fact; that is, a false idea. A delusion, therefore, may be based upon an hallucination or illusion. If he has an hallucination or an illusion, and cannot be persuaded that it is false, then he has a delusion. For example, he may think that he is made of glass, that he is dead, etc., and no amount of proof or persuasion can change his belief. He thinks himself a king, a millionaire, that he is very powerful, that he has an animal in some part of his body, that his bowels are stopped, and has the delusion that he is persecuted. A delusion met with in many varieties of insanity is that the sufferer believes he has changed his sex; men imagining themselves to be women, and *vice versa*. It is usually associated with disease of the genital organs, in which the sexual sensations disappear.

A *lucid interval* is an interval between the paroxysms of insanity, during which the mind appears clear, or the patient is apparently capable of conducting himself sanely (Tuke). It is met with more frequently in the recurrent and epileptic forms of insanity; rarely in the other types.

FEIGNED INSANITY.—Quite frequently you will be called into a court to testify to an individual's sanity or insanity. In criminal cases, in order to prove insanity, and that the origin of the deed proceeded from mental disease, endeavor to establish before, exclusively, and quite independently of the deed itself, the marks of insanity. The deed itself should not be made the distinctive mark, *for no one single mad act* will prove insanity. It is necessary to examine not merely the deed, but also the mental condition of the perpetrator. The history of the case must be studied, as to whether there was any insane or nervous inheritance; whether the patient himself, at any one time or another, has been of unsound mind or epileptic; whether there were any changes in his disposition, character, etc. His acts, both before and after the deed, must be noted. Often the acts of an individual are of as much importance as his words in helping us to arrive at a just appreciation of his mental condition.

The chief points to be brought out in a criminal case (where the question is whether the individual is sane, and working the insanity dodge, or insane) are the cause or causelessness of the crime; the relationship between the crime and the supposed end to be obtained; the relationship between the crime and any delusion. A point very often overlooked by those trying to feign insanity is that they are apt to overdo the matter. They apply wrong names to objects, give senseless answers, and act as if they could no longer count, read, write, or tell their names. As Griesinger says: " He believes that all must be reversed; instead of giving expression to delirious conceptions, he talks absurdly, and conducts himself as if, in insanity, the greater part of the intelligence and memory must be disturbed." Another point in these cases is that the simulator usually has not sufficient acquaintance with the symptoms and course of any one form of insanity so as to correctly feign one type, but he mixes the appearances of several forms, so that an unnatural representation of disease is offered. As a rule, an insane man who has committed a crime will deny his insanity when brought into court, and energetically protest against the suspicion of being insane. There are certain instances, however, where the clinical history of the case, combined with prolonged observation of the patient, can alone enable us to say whether the patient is insane or feigning insanity. Aside from these criminal cases, insanity may be feigned by hysterical or hypochondriacal patients to excite sympathy and pity, or by mendicants for the purpose of charity.

CONCEALED INSANITY.—Occasionally cases are met with where the individual, being aware of his mental derangement, has carefully kept it concealed, not only from the public in general, but from his friends, and even from his relations. This applies, however, only to certain forms of insanity. In such forms of insanity as general paralysis, simple dementia, and acute mania, of course, concealment is impossible.

Causes.—In the greater majority of cases of insanity the beginning of the attack cannot be attributed to the influences of a single specific cause, but is found to be due to a complication of several, sometimes numerous causes, both predisposing and exciting.

PREDISPOSING CAUSES.—No period of life is exempt. Mental disease, generally speaking, is a disease of middle and advanced life, rather than of youth, occurring most frequently between the ages of twenty-five and fifty-five. From fifty-five onward the predisposition begins to decline, but nevertheless there continues, even to the limits of human life, a certain inclination to mental disease.

In regard to sex it cannot be definitely decided whether the one sex be more disposed to insanity than the other. The great physiological crises of life—puberty, adolescence, the climacteric, and senility—are periods which may have an influence on the production of insanity.

No doubt alcohol acts as a predisposing cause, by impairing the nourishment of the nervous system, lowering the general vitality, thereby causing an unstable condition of the brain. Injuries to the head sometimes act as a predisposing cause. Traumatic and syphilitic exostoses and bony formations upon the internal surface of the cranium, in the form of needles and stalactites (the ossified products of a localized inflammation), are met with, and are frequent causes. Certain occupations act as predisposing causes. Any occupation which causes constant care and worry (for example, farmers' wives, governesses, prisoners in solitary confinement, etc.) acts as a predisposing cause. Beggars are said to be remarkably free from insanity, while prostitutes are said to be especially predisposed to it. Privation, starvation, or an innutritious diet, leading to the production of anæmia and constitutional weakness, favor the production of insanity. The immoderate use of certain nervous stimulants, particularly tea, coffee, and tobacco, acts as a cause.

In regard to insanity, the question of heredity is an important factor in its causation. It is, in fact, the chief of the predisposing causes. The subject of heredity is one of great interest, not only on account of its bearing on the transmissibility of disease, but also on account of acquired physical and mental peculiarities, not simply improvements, but essentially defects being transmitted.

As Savage says: " The child carries on from its parent special qualities and dispositions, for without this power of transmission there would be an end to all training and development. If the child did not inherit the result of all that had gone before, with additional powers of development on its own part, all social growth would be rendered impossible. The torch of civilization is handed from father to son, and as with the idiosyncrasies of mind, so its very body itself exhibits well-defined marks of its parentage." Good, bad, and indifferent habits, according as propagation has strengthened or weakened them, are handed down indelibly or feebly fixed upon the offspring.

As an example of the power of transmitting good or bad qualities Lombroso gives two typical groups: First, the Bach family, presenting, perhaps, the fairest example of healthy mental heredity, which produced through eight generations an uninterrupted succession of musicians, many of high rank, inundating Thuringia, Saxony, and Franconia during two centuries. At an annual family gathering are found 120 of the name of Bach, and among them Fétis counts 29 eminent musicians. Second, the Jukes family, producing, in seventy-five years, 200 thieves and murderers, 280 invalids afflicted with blindness, phthisis, or idiocy, 90 harlots, and 300 children who died in infancy.

Bucknill and Tuke studied, with a view of substantiating hereditary transmission, some 600 insane families, and out of these found 440 due to direct inheritance from father or mother, 13 had insane brothers and sisters and collateral relatives, and 147 collateral relatives only.

A family succession of drunkards means, under favorable conditions, a continued drunken posterity as a marriage legacy.

The law of the direct transmission of qualities is that the offspring tends to inherit every attribute of both parents; but where the attributes of the parents are contradictory, the offspring cannot inherit them both. Tuke * says: "Where the attributes of the parents are contradictory, there are three possible alternatives as to the appearance of these attributes in the offspring, namely: (1) The offspring may inherit the attributes of either parent solely. (2) It may inherit the qualities of one parent in some respects, and those of the other parent in other respects. This is the most frequent case, and is susceptible of division according as the qualities of the parents are blended intimately, so that those of the offspring are, as it were, a compromise or average between them; but as the qualities of one parent prevail in one part of the offspring, and those of the other in any other part—for instance, when the offspring of the black buck and the white doe is piebald (*i. e.*, the qualities of the father predominate in one patch and those of the mother in an adjacent patch); or when the offspring of a father of unstable nervous organization and a normal mother is unstable in certain parts of its nervous system or throughout, but to a less degree than its father. (3) The offspring may inherit the father's attributes at one time of life, and at another time these may be displaced by the attributes of the mother."

The subject of heredity has been regarded for generations as having a special bearing upon the occurrence of insanity, and even among the laity it is considered ominous for insanity to exist "in the family." This does not indicate that the parents, grandparents, or some more remote ancestor must necessarily

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* "Dictionary of Psychological Medicine."

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Female. (Agnes.)
Normal.
Married a man of neurotic family.
who has himself had acute mania
several times.
Issue.

Female. (Constance.)
Neurotic.
Married a man of good
stock. Issue one
healthy male child.

Male. (Wesley.)
Insane.
Unmarried.

Male. (Horatio.)
Neurotic.
Married a woman of good stock
Issue.

Male. (Philip.)
Neurotic.
Married a woman of
good stock. Issue one
healthy male child.

Male. (Andrew.)
Normal.

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By Martin W. Barr, M. D., Chief Physician Pennsylvania Traini
Elwyn, Pa. (as quoted by *The Journal of Nervous and Mental Diseases*, M

have suffered from insanity. The nervous peculiarity which exhibits itself as insanity in the offspring may have become apparent in the progenitor, not as insanity, but as epilepsy, as chorea, as hysteria, or as somnambulism—in fact, any affection in which there is an instability or disorder of the highest nervous arrangements. Or, in other words, parents who are hysterical, epileptic, or otherwise defective in nervous organization may have offspring who become insane; or *vice versa*. Insanity may frequently alternate with other nervous affections; take, for instance, gout and insanity; when the gout is better, the insanity is worse, and *vice versa*. Brodie mentions a case where a neuralgic state of the vertebral column alternated with true insanity; also, it is not at all rare to see in a family certain members suffering from insanity, and others from epilepsy, severe spinal irritation, hysteria, neuralgia, migraine, etc. According to Esquirol (as quoted by Griesinger) insanity is more frequently transmitted (almost one-third oftener) from the mother than from the father to the children, and also that it is more especially the children of the female sex who inherit this unfavorable disposition.

Children born before the period of manifestation of the mental disease are less frequently attacked than those born after either parent has become insane. Direct inheritance is greatest during the period of insanity and immediately before and after it, so that if the father is insane at or near the time of the begetting, or if the mother is insane during or soon after the pregnancy, the risk of insanity in the offspring is increased. A peculiar feature of many of these hereditary mental derangements is the appearance of the malady at the same time of life, and in many instances under similar circumstances; for instance, the tendency to suicide and the appearance of insanity in mother and daughter at or after childbirth. It is remarkable to see how very precise the similarities of the nervous derangement in parents and children may be. The suicidal tendency is one which appears to be most directly and distinctly transmitted, even coming on in all the members of a family at the same age. Esquirol tells of a family in which for three successive generations the males committed suicide in or near their fiftieth year.

A universal and certain law in regard to nervous heredity is that the *stronger* the predisposition the *sooner* it manifests itself in life, and the *weaker* it is the *later* in life it shows itself. When insanity appears earlier and earlier in life in succeeding generations, it is a sign that the insanity is on the increase in that line of descendants; while if the insanity appears later and later in life of succeeding generations, it is a good omen, and is a sign that insanity is dying out in that line of descendants.

Consanguinity (marriage of blood relations) is another factor in a great many cases in the production of nervous diseases. Now by this statement we do not intend to infer that the marriage of close kinship is alone sufficient cause to produce nervous troubles in their offspring. A common belief in the public mind is that the marriage of cousins is sure to result in the production of idiots, when the true fact of the case is that consanguinity has little to do with it. If the stock of blood is pure in their progenitors, the result of the union of close kinship is generally more beneficial than otherwise.

Lancry * observed that four families of Picardy, who established themselves in 1670 at Fort Mardick in the Flemish province near Dunkerque, practicing consanguineous marriages, formed in 1886 a population of 1481 inhabitants, who appeared to have excellent health and vigorous constitutions.

Dr. Bourgeois (as quoted by Hammond) wrote the history of his own family, which was the issue of a union in the third degree of consanguinity. During the ensuing 160 years there were 91 marriages, of which 16 were consanguineous; of these latter, all were productive, and there was not a single case of malformation or other physical or mental disease in the offspring.

There are many other instances of isolated communities intermarrying continually without detriment to the offspring. In the early history of mankind marriages among blood rela-

* Quoted by the *Journal of Annual Medical Science.*

tions were quite common. The Persians, Tartars, and Egyptians not only married their sisters, but also their daughters. Among the Greeks brothers and sisters of the same father, but of different mothers, could marry each other. When the Ptolemies, of Grecian descent, became the sovereigns of Egypt, the brothers and sisters frequently intermarried for dynastic reasons. Cleopatra, the beautiful and seductive, married her two brothers, Ptolemy XII. and Ptolemy XIII. In France, and even in our own country, several of the States permit first cousins to marry; also uncle and niece or aunt and nephew, and the consequences are far less harmful than is generally supposed. The Jews, notwithstanding the prohibition of Moses, continue consanguineous marriages up to the present day. All civilized nations allow consanguineous marriages within certain degrees. Though the marriage of blood relations may intensify hereditary tendencies, it does not create them in a healthy parent.

Consanguineous marriages are not in themselves productive of evil results, but the danger of such marriages lies in the fact that the evil influence which morbid heredity exerts upon the offspring is just twice as great, on account of both parents coming from the same family stock; that is, the influence of a consanguineous marriage is simply the influence of a double heredity. Persons with weak nervous systems are likely to beget children with weak nervous systems also. This tendency, then, if present where two near relations (of nervous, but not necessarily insane stock) marry, is likely to result in the birth of idiots, imbeciles, deaf-mutes, or in children who become in after years the subjects of epilepsy, insanity, and other affections of the nervous system.

If it were absolutely certain that a family were entirely free from all morbid hereditary influences, there would be no reason whatever for prohibiting consanguineous marriages, but as this fact can rarely, if ever, be positively ascertained, it is better to prohibit such marriages down to, or even including, second cousins; for it frequently happens that the interested parties are very careful to conceal any hereditary taint. It is, therefore, best to exercise the most extreme prudence in authorizing the marriage of near relations.

EXCITING OR IMMEDIATE CAUSES.—In many cases it is difficult or impossible to decide upon the moral or physical exciting cause of the outbreak of insanity. Overexcitation of the brain, whether produced by such emotions as sudden anger, joy, sorrow, or fright, or by unduly prolonged intellectual action (moral cause of some writers), may, without the interference of any other morbid factor, induce insanity. A shock from the sudden death of near relations, loss of fortune, religious excitement, etc., may also cause an outbreak of insanity. Acute febrile diseases of different kinds, more especially scarlet fever, small-pox, typhoid, or pneumonia, may give rise to outbreaks of insanity. Rape or attempted rape may be the origin of an attack. Marriage, brutality, or excesses on the part of the husband on the marriage night have been known to induce an attack (post-connubial insanity). Pregnancy, childbirth, and lactation may act as causes. Heart disease, kidney disease, or pulmonary tuberculosis appear to be sometimes the cause of development of insanity. Anæmia or congestion of the brain may induce an attack. Peripheral irritation of every kind, but more especially of the abdominal and pelvic organs, may act as a cause. In the female, diseases (or displacements) of the uterus, ovaries, and vagina act as causes; also menstrual disorders, as amenorrhœa, dysmenorrhea, etc. Sudden stoppages of the menstrual flow are occasionally found to be the direct cause of a maniacal attack. Esquirol has said that the derangements of menstruation form one-sixth of the physical causes of insanity. In the male, all those disorders of the sexual functions, as stricture, prostatitis, etc., act as causes. Sexual excesses or self abuse sometimes act as causes. Idiopathic or morbid processes may induce attacks.

Any cause or causes lowering the nutrition, all true states of weakness, and all circumstances which overexcite the nervous system or favor congestion of the nervous centers may have an influence in the production of insanity.

We speak, however, of so and so being causes, when in fact they are usually only the determining factors which start into activity a pre-existing constitutional condition. What will induce insanity in one individual will not in another. Certain forms of insanity, as well as other disorders of the nervous system, spread by imitation among predisposed individuals; for example, erotomania and hysterical insanity.

Pathology.*—As regards the pathology of insanity, with the exception of paralytic dementia (which is more fully described under that heading), very little is as yet known. There is no distinctive pathological condition of the brain which may be considered characteristic or pathognomonic of mental disease. Insanity not being a disease, but only a symptom of diseased cerebral action, it would be a mistake to expect to always find coarse structural alterations of the brain. True, innumerable brain lesions of almost every kind have been met with in different cases. In other cases, however, no abnormal condition of the brain has been found. Even where lesions are discovered, they are to be considered the consequence, rather than the cause, of disordered function. In many cases of insanity there is nothing but a functional disturbance of the finer molecular changes of nervous matter, which is manifested by augmented impressionability, nervousness, and a neuropathic temper. Even the highest powers of the microscope fail to distinguish any difference between the nerve-cells and their fibers of insane and healthy persons.

In many cases nothing has been found beyond a very slight degree of cortical hyperæmia, not differing from the hyperæmia found in some persons dying from various causes. Again, in other cases there may be found a marked fullness of the cerebral blood-vessels, which in extreme instances may be accompanied by hemorrhage or hemorrhaginous transudations. Griesinger says that the most important and most constant changes in the insane consist in diffuse disease of the external layers of the cortical substances—that is, of the surface of the brain and also of the membranes covering it. A morbid condition met with quite frequently in the insane, especially in melancholia, is degenerative lung disease. Cases of melancholia are often found, after death, to have large cavities in the lungs. Every case of melancholia, whether young or old, with or without general symptoms, should be examined for lung disease.

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* In the greater majority of cases mental disease or insanity is simply the result of disturbed cell-action in the brain-substance. This cell-action in the brain and everywhere in the body is controlled by the sympathetic nervous system. True, the sympathetic nervous system may be influenced by external causes through the cerebro-spinal system, yet the ultimate influence and power belong to the sympathetic.

Prognosis.—The prognosis will depend upon the form of the insanity and the period of the disease. General paralysis of the insane, as a rule, is incurable. Secondary dementia and chronic mania are rarely ever cured; occasionally, however, they admit of considerable improvement. Insanity at an early age is more frequently cured than when it occurs in advanced years. The prognosis for puerperal insanity is the most favorable of all the different forms. Those recoveries which take place gradually are, generally speaking, more lasting than rapid and sudden recoveries. Strongly hereditary cases are the most curable of all, but they are most liable to recur; though many of them are undoubtedly incurable from the beginning.

Undoubtedly, many cases of insanity recover completely, leaving not a trace behind in any shape or form. It is a grave injustice to regard all individuals who have been insane as tainted and unfit to occupy their position in society and business. Cases are far more numerous, however, where indeed the leading symptoms of insanity disappear, but the individual retains a slight feebleness of intellect, continues irritable in temper, or is possessed of certain eccentricities (may be solitary, penurious, given to odd ways of dressing and of living, and may be in the habit of talking to himself), which, however, permit him to take part in the simple avocations of life, and it may be to return to his former business pursuits. In other cases it may

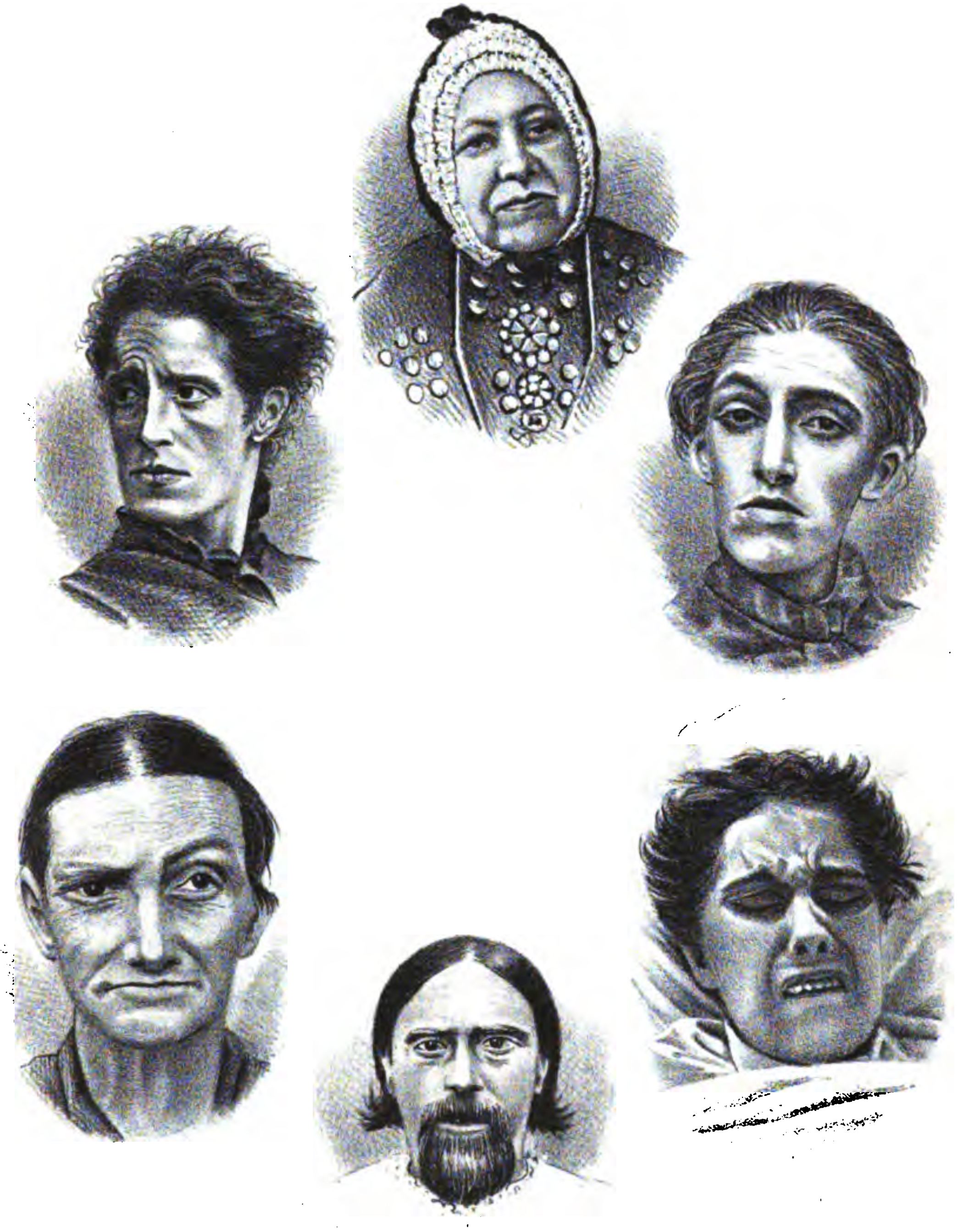

PLATE XVII. SEE REVERSE FOR DESCRIPTION. FIG. 81.

FIG. 81, PLATE XVII.—THE PHYSIOGNOMICAL EXPRESSIONS ARE OF THE MOST MARKED CHARACTER, AND ILLUSTRATE CASES OF EROTOMANIA, DELUSIONAL INSANITY, APATHETIC DEMENTIA, MELANCHOLIA, ACUTE MELANCHOLIA, AND SECONDARY DEMENTIA. (After Hack Tuke.)

1.—The patient whose physiognomy is here represented labored for many years under the fixed delusion that she was a queen. Her expression and bearing were to the last degree characteristic of exaltation and a sense of her royal dignity. Her dress was studded in front with silver coin to mark her exalted rank. When photographed she was delighted with this mark of attention, and exclaimed, "Now photograph my back."

2.—Represents the face of a patient formerly in the Norfolk County Asylum under the care of Dr. Hills. She developed a large head and mustache. Her case was one of sexual perversion.

3.—F. M. L., age twenty-one; her insanity on admission two years ago was of two years' duration. She was then maniacal for a week or so, but quieted down, and ever since has been in an apathetic condition, gradually drifting into dementia, sitting huddled up with her head bent down, speaking in a whisper and never spontaneously; only moving when urged; fond of chewing bits of paper. With the increase of degenerative brain changes, asymmetrical conditions appeared first in the face and then in the trunk. These began by slight elevations of the left eyebrow, which was more arched than the right. The elevation became more and more marked, when present, but at no time was it a fixed condition, being only assumed with certain emotional states. (This patient afterward died of phthisis.)

4.—Anna T., age thirty-two, admitted in good health and suffering from acutely melancholic symptoms, which had appeared within a few weeks of admission. She was restless, resistive, and troublesome; her face wore a mingled expression of perplexity, misery, and fear. This woman, after a little while, lost most of her active symptoms, became silent and mulish, and her face grew fat and expressionless.

5.—Female patient who had delusion that her child was dead. Whenever reference was made to the subject her face assumed the expression seen in the figure.

6.—Face of female patient showing strong contraction, mainly of the outer half of the right occipito-frontalis; neither corrugator is acting. She is in a state of secondary dementia, her insanity being of many years' standing. She is intensely silly, gives and makes foolish, irrelevant answers when spoken to. If left to herself she will sit unoccupied all day with her right eyebrow elevated more than an inch. This condition gives a stupid look to her face; it assimilates to no recognized form of expression, nor is it intensified with any emotional state; indeed, if her attention is attracted in any way it generally disappears.

leave a few prominent delusions. In the majority of cases, however, an attack of insanity leaves the patient more or less mentally crippled. He is not the same after having had an attack of insanity as he was before. In a great number of cases it leaves the patient a complete mental wreck.

After a severe bodily illness, patients feel weak in body, gaining their strength slowly but gradually, until their normal standard of health is recovered. Just so after a similar disorder of the mind there is intellectual weakness, which it will take time to strengthen and build up. When reason begins to return, it becomes necessary to aid his comprehension by explanation and palpable evidence, in order to completely counteract the false ideas which occasionally arise, although, upon the whole, they are recognized by him as false.

Relapses occur by far more frequently during the first and second years after recovery. Upon the whole, however, the prospects of recovery in insanity (especially in recent acute insanity) are much more favorable than is generally supposed by medical men and the public.

VARIOUS FORMS OF INSANITY.

It would be impossible, in the time we have to devote to this subject, to undertake to describe all the different forms of insanity met with in and out of asylums. We can only give a brief summary of certain well-known types with which every physician sooner or later meets, and is called upon to decide as to whether it shall be *home* or *asylum* treatment.

In describing the different forms of insanity, we shall give only the salient points of diagnosis for special forms, and not attempt to cover rare and exceptional cases. The absolute diagnosis in all these cases can only be made with the aid of the previous or the subsequent history of the case.

In a great many cases the different types described are only different stages of one morbid process, which may be modified. interrupted, or transformed by the most varied intercurrent pathological circumstances, but which, on the whole, pursues a constantly progressive course, which may proceed even to complete destruction of mental life. (Griesinger.)

The different types are, in reality, only a classification of symptoms, not of real diseases; for our present knowledge of the pathological processes which constitute the different forms of insanity does not justify an attempt to classify them according to the nature of the disease alone. Spitzka likens hereditary insanities unto a chain, monomania being placed at one end and idiocy at the other, the intervening links representing the various forms of insanity met with, and as the links gradually merge and connect with one another, so with the different forms of insanity; hence, it is not possible to draw absolute lines of demarcation between the different forms comprising the series.

The forms of insanity which we shall describe have been established by carefully selecting the most characteristic states and connecting them into typical classes. There are, however, many intermediate connections, mixed forms, imperfectly marked states, which do not exactly correspond to these classes. But we cannot, because the case does not completely coincide with one or the other of these chief varieties, come to the conclusion that no mental disorder is present.

Owing to the unsettled basis upon which the classification of insanity is made (some writers trying to classify according to pathology, others as to symptomatology, etc.), we think that it will be less confusing and will answer all practical purposes to simply enumerate the various typical forms most frequently met with.

Melancholia.

Melancholia is a state of mental depression, characterized by a feeling of misery, which is in excess of what is justified by the circumstances in which the individual is placed. The patient's depressed feelings all center around himself, his health, or the performance of his bodily and mental functions. Melancholia may be a complete process in itself—that is, beginning, running its course, and terminating as melancholia—or it may be the initial stage of any mental disorder; or again, it may follow other varieties of insanity.

There are many varieties (some thirty odd) of melancholia; for example, where the patient runs around, wringing his hands, weeping, and crying out against his persecutors, it is termed *melancholia agita; melancholia attonita,* signifying thunderstruck, the stupor being so great; *suicidal,* where the tendency to self-destruction is the chief symptom; *delusional,* where fixed

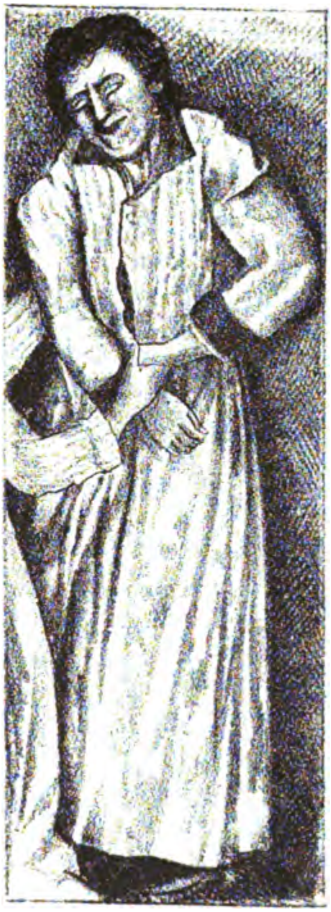

FIG. 82.—PHOTOGRAPH OF A CASE OF MELANCHOLIA ATTONITA. (After Dr. L. C. Gray.)

delusions remain throughout the disease of the same character, and are from the beginning the most prominent mental symptoms.

It will not be necessary to consider all these varieties in detail, however great the difference between them as to the intensity and direction of the symptoms, as they all have the fundamental character of melancholia—namely, *a depressed mental state.*

In the milder forms of melancholia there may only be slight perversion of feeling, yet they always have the characteristic feature of melancholia—mental depression. It begins in nearly all patients as simple lowness of spirits, or a lack of enjoyment in occupation or amusements, and loss of interest in life. *Sleeplessness* and *loss of bodily weight* are two marked symptoms of this affection. The patient is noticed to be somewhat dull, somewhat lethargic, somewhat uneasy, and in less than his usual spirits. He almost always insists upon being carefully examined as to the condition of his lungs and heart, and if the patient is a male, more especially as to his sexual organs. The memory is good, and he can speak and answer questions accurately. The sight, sounds, and sensations that were wont to give pleasure now cause mental pain. He has lost all interest in his work; he feels that his life has been wasted and a failure; that he has not done his duty to his wife and his children. He is capable of feeling no joy in life, it being almost impossible to make him smile, the future having a gloomy outlook for him.

The personal habits tend to become untidy, slovenly, and dirty. His digestion is slow; the appetite immoderate or diminished; the tongue is coated; the bowels are constipated; sexual desire is diminished, or lost; and the skin harsher and drier than normal. Dr. L. C. Gray speaks of certain symptoms that are of great diagnostic value in certain forms of simple melancholia—namely, an obstinate insomnia and peculiar sensations in the back of the head and neck, or at the vertex, or up and down the spine.

These cases of mild melancholia resemble hypochondria in many respects, the chief points of difference being that in melancholia he is unable to throw off the intense mental depression from which he suffers, that he cannot at will withdraw his mind and speech from his delusions, and that his woes are mental and not physical. A case may remain as simple melancholia from beginning to end, or it may assume one or the other of the more serious varieties of melancholia; or, again, it may pass into mania.

In more severe cases he becomes careless, indolent, slovenly, and even indecent in his manner and dress; he takes the gloomiest views of himself and all his concerns; he believes that his business is going to "rack and ruin," that his credit is gone, that he is absolutely penniless, and that he and his family will end in the poorhouse. The future has no hope, the past no consolation; they are alike dark and cloudy. He becomes suspicious and thinks that people are watching him; that the police are following him; that unseen agents are working against him; that he is being hypnotized; that mesmerists and conjurors prevent him from sleeping; that his friends are combining against him; that someone is working in him by means of concealed batteries, or that he is persecuted in various ways by his relatives. In other cases the patient weeps, wringing his hands, heaves deep sighs, or is engaged in prayer and supplications; believes that he is lost, or that he has committed the "unpardonable sin," or that he has committed a heinous crime for which he ought to be punished and may even go to the magistrate and give himself up, but he is unable to recall what this crime was but fixes upon some insignificant act or some petty carelessness, of which, in all probability, he was entirely guiltless. Such patients believe, for example, that they are dead, or have lost their personality, or that portions of their body have been changed, the head is of wood, the limbs of glass, or that they have no mouth, stomach, or intestines, or that the bowels are stopped up and nothing will pass through; that they have foul breaths and smells from their body (olfactory hallucinations) that make them offensive to those around them; or that they are surrounded by dead bodies; or that they themselves are in a state of putrefaction. They hear the voices of the devil, smell the brimstone, and see the flames. They may develop the delusion that devils, or mice, or frogs are inside of them; voices are constantly heard, by day and by night, which seem to reproach them, to insult them, to accuse them of some crime, or to threaten them with death. They all say that their food does and will do them no good. They often refuse food, not only from their mistaken ideas of being poisoned, or from their belief that they are commanded by God not to eat, that it is a sin to eat, or that they have no mouth or stomach, or that the bowels are stopped up, but also from the generally disordered state of nutrition that gives them an absolute disgust for all nourishment and an unconquerable and instinctive aversion for all food.

The nutrition of the body frequently suffers, the patient becomes thin and emaciated; the skin wrinkles and dries up, appears dewy and greasy, and gives a feeling of coldness to the touch; the extremities are cold and livid, indicating a poor circulation. The expression of the countenance is characteristic of this disease. The jaws are not firmly closed, the lower jaw falls away from the upper with or without parting of the lips, and this gives the face an elongated appearance; the eyebrows are wrinkled; the angles of the mouth are drawn downward; the eyes are almost always cast downward, or, on the other hand, widely open and fixed, with the expression of suffering and painful tension, or of astonishment. The eyes, however, are generally full of tears as though they had been weeping; the general expression is that they have been or are about to weep. In fact, the face indexes the depressed emotions of the mind and body accurately. Melancholiacs frequently complain of painful sensations in the head, as sensations of heat, of pressure, of weight, a feeling of emptiness of the head, or of water running in the brain.

In another class of cases a peculiar feature of the disease is an unreasoning passive or active resistance to anything you want them to do. They resist being dressed, or, when dressed, they resist being undressed; it takes two or three persons to dress or undress them, and as many to feed them, and they can give no reason why they resist.

In another class of cases the predominant symptom is a tendency to *suicide*. They may kill themselves because voices command them to or on account of believing themselves followed or persecuted, etc. A peculiar feature in many suicidal patients is that they desire to put an end to their lives by means of a certain method; they will avoid danger or even death by any other method in order to accomplish their end. For instance, patients have been known to swim a river to throw themselves in front of a passing train on the opposite side. Closely allied to the suicidal tendency is that where the patients mutilate themselves, cut off their fingers, tear out their eyes, cut off their testicles, etc. The homicidal feeling is much rarer in melancholia than the suicidal.

In the most severe forms of melancholia (melancholia with stupor), the delusions of the patient are more intensely believed in; and the mental depression is much more profound than in any one of the other forms. The patient sits motionless and perfectly mute, his hands clasped before him, his head bent forward, his eyes closed, staring vacantly, or fixed upon the floor; the features are fixed, giving to the face the appearance of a mask. Sometimes he will sit in a corner all day without taking the slightest notice of anything that is going on around him and will not answer when spoken to. Some may stand like statues, neither eating nor speaking (only as they are forced to), nor allow anything to be done for them. They often neglect the calls of nature and become wet, dirty, and filthy. In this class of patients the bodily functions are seriously affected; the body is emaciated, the complexion sallow, the skin harsh, and the secretions in general deranged. Constipation, so common in all forms of melancholia, is extreme in this form, and the nutritive disturbances generally are most marked in melancholia *cum* stupor.

A person recovering, and found to have retained his consciousness (memory) through the whole period of illness, may be looked upon as suffering from melancholia with stupor; whereas, if recovery takes place and the past is found to have left no trace in the memory, it must be diagnosed as acute (primary) dementia. The following table gives points of differential diagnosis between melancholia with stupor and dementia (Griesinger as quoted by Savage):

MELANCHOLIA WITH STUPOR.	DEMENTIA.
1. Development, often rapid.	1. Slow.
2. Nutrition, fails.	2. Often good.
3. Complexion, yellow.	3. Normal.
4. Excretions, deficient.	4. Normal.
5. Sleep, bad.	5. Good.
6. Opposition to all movements.	6. Passive.
7. Appetite, refusal of food.	7. Voracious
8. Suicidal.	8. Not suicidal.
9. Memory, present.	9. Absent.

The chief point of differential diagnosis, however, is that a person recovering and having a recollection of misery associated with his illness must be looked upon as suffering from melancholia with stupor; whereas the patient suffering from acute (primary) dementia would have no such recollection.

Prognosis and Course.—In the mild forms of melancholia recovery is the rule; it never kills directly, only by exhaustion, and seldom ends in dementia. It usually requires from three to twelve months to effect a cure. In melancholia with stupor the prognosis is not so favorable; many live for years in much the same condition, having to be watched and fed like children. In those cases where the stupor is so profound that the nutrition becomes impaired, their general vitality is lowered, and they are more subject to some intercurrent trouble, most frequently phthisis; or, again, a few of them end in dementia. Melancholia may suddenly pass off, the person awakening as from a dream. In most cases, however, recovery is gradual and is associated with improvement in general health.

Treatment.—Every physician is called upon, sooner or later, to undertake the treatment of cases of insanity among his patients, and especially is this true of melancholia. The greater majority of these cases can be treated at home as well as, if not better than, at an asylum. If you decide to retain them at home, the first thing to do is to select a bright and cheery-looking room or rooms, that can be well ventilated, and in which the patient can, practically, be isolated from the rest of the family.

It is usually found, when a melancholic patient comes under treatment, that for a considerable time he has not taken a sufficiency of food. Often the patient has a positive distaste for food, and not unfrequently there is complete and obstinate refusal to take it. As a consequence, such subjects are thin, emaciated, and generally present a " bilious " appearance. Do not be deceived in believing that a foully coated tongue indicates biliousness, and that food is contra-indicated. The chief factor in the treatment of these cases of melancholia is to strengthen the constitution and improve the general nutrition, by the judicious selection of the most nutritious food that can be partaken of. It is not enough to depend upon concentrated essence of meat and peptic fluids, etc., but you must give of such articles as milk, eggs, minced beef, and vegetables of various kinds as often as the patient can be persuaded to eat, and in large quantities. For it is only by pushing the feeding process, if we may be permitted to use the term, that the greatest benefit is to be obtained.

The refusal of food is one of the most dangerous symptoms and one for which steps will have to be taken at once if life is to be saved. If left alone, in many instances the patient dies or becomes demented.*

Forcible feeding should never be resorted to if you can persuade them to take food in a natural manner; but when persuasion, threats, and all moral means have failed, then you must resort to forced feeding.

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* Brissaud and Sauques call attention to the fact that if in animals emaciation exceeds six-tenths of the initial weight, restoration is impossible, and they infer that a similar law holds good for the human organism ; so that there is nothing to prevent a fatal termination in extreme cases of emaciation, and undoubtedly there are many instances of such termination in those severe forms of melancholia.

The exercise should consist of driving or walking, supplemented with some kind of employment at home. By inducing them to engage in some kind of physical employment it distracts their mind from their mental condition.

In the more severe forms of melancholia (melancholia with stupor) Dr. S. H. Talcott recommends that the patients should be placed in bed and kept there; that they should no more be allowed to sit up, or stand, or walk around, than a patient who is passing through a course of continued fever. Constant and patient watching and nursing are imperatively necessary. Careful attention must be paid to the condition of the bladder and bowels, and these should be evacuated of their contents, by artificial means, at regular intervals; otherwise, serious dangers would spring from overdistention of the former or impaction of the latter. Baths, especially the sitz bath, should be used freely in these cases. They promote the action of the skin, and keep it in a healthy condition, thus relieving the internal organs of their superabundant load. Morphia and the opiates should be left severely alone, for they not only dry up the secretions, but also increase the antipathy to food.

In the therapeutical treatment, each case will have to be carefully individualized in selecting the proper remedy.

Actea rac. (*cimicifuga*).—Great mental depression; miserable, dejected feeling; desire of being alone and dislike to talk; likes to sit by herself and weep; fears she will go crazy; suspicious of everything; would not take medicine if she knew it; a confused feeling; people and objects appear strange and unnatural; dull pressure or pain on vertex and in occiput; brain feels as if too large; pressing from within outward; top of head feels as if it would fly off, or an opening and shutting sensation of skull when moving head and eyes.

Ambra grisea.—Melancholy, sits for days weeping; with great weakness, loss of muscular power; pain in the small of the back, with constipation, distorted images, grimaces; diabolical faces crowd upon his fancy; despair and loathing of life.

Arsenicum.—Fixed idea that his family will die of starvation; melancholy after financial losses; cannot be consoled; sleepless nights; walks about wringing his hands, with moaning and groaning. Religious melancholia; hopelessness and despair.

Arum.—Great mental depression; looks on the dark side of life, weeps, prays, thinks he is not fit for this world; the mind constantly dwells upon suicide; imagines he cannot succeed in anything, and he does everything wrong; that he has lost the affection of his friends; that he is neglectful and deserves reproach in consequence.

Alumina.—The alumina patient is very low-spirited and inclined to weep; the low-spiritedness is worse on awakening; fears that he will go crazy; the sight of blood or a knife develops a suicidal tendency; makes mistakes in speaking, using words not intended.

Chamomilla.—Patient constantly moaning and muttering to herself; walks all the time, looking down; is disinclined to talk; angry if anyone speaks to her; tries to get away from her friends, if they seek to comfort her; sleepless at night and uneasy during the day.

Cyclamen.—Absorbed in deep thought, seeks solitude, thinks about his future; loss of former cheerfulness; solitude and weeping give relief; ill-humored, morose mood; could easily take offense at every trifle; delusion of being deserted or persecuted by everyone. Especially called for in melancholia occurring about the climateric period.

Lachesis.—The patient is nervous and anxious; fears of being poisoned; refuses medicine and food; imagines that he is dead, and preparations are being made for the funeral; develops the delusion that he is persecuted; pursued by enemies. The patient is *worse after sleeping.*

Nux vom.—Irritable, morose, sullen, quarrelsome, or inclined to get angry or excited if disturbed; ill-humored, resists obstinately everything that is being done for her; sits for hours still and absorbed, looking before him; no interest in anything, and answers questions incoherently, if at all; dull, pressive pain in the forehead and above the eyes, as if one had not slept enough; headache in the forehead as if the eyes would be pressed out; no appetite; tongue coated white; bitter or sour taste in morning, with offensive breath.

Naja.—Great depression of spirits; broods over possible wrongs and misfortunes; temporo-frontal headache; spinal pain and palpitation of the heart; sleep full of frightful dreams. Naja is especially called for in suicidal melancholia.

Opium.—Stupid indifference; will be aroused for a moment when addressed in a loud tone of voice and then relapse into stupor.

Pulsatilla.—Religious melancholia; greatly concerned about her worldly and eternal well-being; despairs of her salvation, and seeks aid in constant prayer; sleepless, restless, and changeable; easily moved to tears or laughter; well one hour, miserable the next; headache, chiefly in the forehead, supraorbital regions, and in temples; heat and congestion to head and face; or pale face, cold hands, with flushes of heat; precordial weight and backache; tongue coated white or yellow, with tenacious mucus, as with a membrane; sensation on middle of tongue as if it had been burnt; edges of tongue feel sore as if scalded; biting on tip of tongue, bad taste in mouth, especially in morning.

Sepia.—Great indifference to one's family; to those they love best; easily affected and inclined to be vehement; dark forebodings about his disease; in regard to the future; fears that he will starve; suicidal tendencies from despair about his miserable existence; hot flashes; headache with aversion to all kinds of food; tongue coated white; with mucus; dirty yellow; brown with red edges.

Stramonium.—Religious and satanic ideas; ideas of persecution of an erotic nature, and in which the patient touches constantly the genital organs, and practices self-abuse in a violent manner under the stimulus of baseless conceptions and erroneous surmises. Especially indicated in melancholia the effect of masturbation; also in nymphomania, puerperal or menstrual, with outbreaks of violence.

Thuja.—The thuja patient has the "fixed" delusion that he is made out of glass or of some brittle substance, and will not allow persons to touch him for fear that he will be broken; she has the delusion that strange persons are at her side; that her soul and body is separated; that she is under the influence of mesmerists or spiritualists.

Veratrum alb.—Sleepless; talks much on religious subjects; he sits brooding in silence with head hanging down; he distrusts everyone; despairs of his recovery; attempts suicide; is subject to frightful dreams; sensation like a piece of ice on the head; cold sweat on forehead; skin blue, purple, cold, and wrinkled; extremities cold. The veratrum patient is usually very restless, wild looking, with blue circles around the eyes, face pale or of leaden hue.

In regard to the use of electricity in the treatment of melancholia, Riggs * says: "In melancholia I have found electricity a most valuable remedial agent. Again and again I have seen the hallucinations and fixed ideas, so well marked in this disorder, disappear under its use, and it is the general testimony of the profession that this psychosis is especially amenable to electrical treatment. . . I use in melancholia, static insulation combined with galvanization of the medulla, spine, and brain, or general galvanization."

Mania.

This is a form of insanity, characterized by mental exaltation and bodily excitement, usually accompanied by insane delusions, always by complete change in the habits and modes of life, mentally and bodily, by loss of self-control, with at times absolute incoherence of speech and loss of consciousness and memory. (Clouston.)

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* "International System of Electro-Therapeutics."

Mania may be the whole of the disordered process beginning and running its course and ending as mania; or it may be a stage in recurrent insanity; or it may be the first or one of the earlier symptoms of general paralysis of the insane; or it may be associated with, precede, or follow epilepsy; or it may take the place of the fit. In melancholia we saw that there were several forms, but all having as their fundamental basis *mental depression;* so in mania there are several varieties, however much they may vary in their intensity and direction of their symptoms, and all are one and the same disorder, having for their fundamental basis *mental exaltation.*

The attack of mania may be preceded by a prodromal stage, which may last several days or even weeks. It is noticed that the patient is "changed" in disposition, altered in conduct, unsettled, always talking, he is impatient and petulant; he is excessively irritable in temper, easily angered about trifles, and even without cause; he is unreasonable and suspicious, complains of a feeling of illness, great prostration, headache or confused feeling in the head, a feeling that something is going wrong or something terrible is going to happen; he has an impulsive desire to do something, to break glass, or do violence to those within reach; he is subject to sleeplessness, or the sleep is broken and unrefreshing. Not infrequently there is exaggeration of the sexual desires, or an abnormal craving for alcoholic stimulants; he is subject to digestive troubles. When the mania is fully pronounced, the feeling of illness disappears, and the patient expresses himself as "quite well."

In the milder forms of mania (sometimes called simple mania) the disease may show itself in eccentric and aimless actions. He acts like a person who is slightly under the influence of some stimulant; may be boisterous, gay, and frivolous; does childish and foolish things; has an exalted notion of his own power and importance; is boastful to absurdity, bragging of what he can do and is going to do, and of the great personages he has known. He is extravagant, gives away his money, foolishly quarrels with his relatives and friends because they remonstrate with him; he becomes changed in his mode of dressing, in the company he keeps, and in his manner of living; he becomes rash, utterly careless of his business, foolish in his schemes, and is liable to commit dishonest acts where previously he was an upright and honest man. Great enterprises are undertaken, to be followed but a short time and then abandoned. Again, there may be entire want of interest in anything going on around him; he neglects his business, goes on long journeys without motive or reason; all sorts of ridiculous and absurd contracts are entered into. Marriages are contracted, fortunes run through with, etc. These are the individuals who are always calling upon or writing letters of advice to noted personages or public officials, instructing them in their duties—in short, what are commonly known as "cranks." Hallucinations, illusions, and delusions are entirely absent, or only present in a slight degree. A case may continue as simple mania from beginning to end, or it may be the the first stage of acute mania.

In a more severe form (acute mania) the patients may be subject to harmless actions, such as dancing, speaking in rhythmical form of conversation, chattering, shrieking, laughing, whistling, swearing, weeping, etc., or they may exhibit an angry, defiant, or savage disposition, or a tendency to destroy everything within reach; with outbreaks of the blindest fury and rage; hence the term *raving maniac.*

In some cases the patient talks incessantly, whether anyone is present or not; at times there may be absolute incoherence; the patient is restless by day and sleepless by night. Insomnia may be a persistent and troublesome symptom, the patient going for days and often weeks with little or no sleep.

They frequently object to wearing clothing, going about half naked, with hair disheveled; lose all sense of decency, modesty, and propriety. There may be hallucinations or illusions more frequently of the sense of sight and hearing. Delusions are frequently met with, but are not present in every case. Many cases of mania run the entire course without them.

The most important thing to ascertain about delusions in mania is whether they are " fixed " or " fleeting." In that form of mania termed *delusional mania* the delusions are much more marked than in the other forms. The mental and physical activity is almost always greater and the patient becomes confused and incoherent.

In another class of cases (homicidal mania) there are strong homicidal tendencies. The patient believes that he is persecuted or about to be killed, and commits the crime, as he thinks, in self-defense; in others, however, there is a distinct morbid desire, impulse, and craving to kill.

In the earlier stages there may be an exaltation, but in the later there is usually a blunting of the common sensibility. In many instances the patient retains a remembrance of what transpired during the attack, though it may be in a distorted way, while in others the whole period of the disease is a complete blank.

Acute mania may run its course within a period of from three to nine months, and the patient becomes as sane and reasonable as ever he was in his life; or it may pass into a state known as *chronic mania*—a state of noisy incoherence, the patient chattering the whole day long, generally in an aggrieved way, or with threatening and abusive language. In some instances (of chronic mania) the patients occupy themselves in gathering up pebbles and stones, which they imagine represent vast sums of wealth; others bedeck themselves with every rag, piece of cloth, feathers, etc., upon which they can lay their hands. These patients are, however, generally considered harmless, and in many instances can be permitted to return home. Griesinger, speaking of this class of patients, says: " The emotional dullness of the chronic maniac is very characteristically manifested in his relations to the asylum. The individuals are almost always, without exception, quite contented with their lot; they never form plots (which, owing to their number, they could easily do), a single attendant leads them like a flock of sheep; should one of them suffer punishment or be removed, the circumstance does not at all affect the others." Yet, notwithstanding the apparently harmless state, some of the most revolting crimes have been perpetrated by the so called " harmless " and " inoffensive " maniacs.

In all these various forms of mania, and developing simultaneously with those physical symptoms just described, there are present certain signs of derangement of the digestive functions and the nutrition. As the disease advances, the patient tends to rapidly lose flesh, and becomes emaciated; the skin becomes dry and disheveled, which partly accounts for the aged appearance that cases of mania soon put on. More rarely, however, the skin is greasy and clammy. Rarely do maniacs perspire freely. The hair, in many cases, becomes rough and bristling. The appetite is variable; in the early stages there may be little or no desire for food; later it may become capricious and unnatural; and still later, if the patient be passing into the more chronic state, it becomes almost insatiable. " The rule is, as the disease advances there is a tendency to voracity; but, notwithstanding his ravenous appetite, the patient does not gain flesh as long as his state remains purely maniacal." (Tuke.) The breath is foul; the tongue is foully coated, or assumes a red, irritable appearance, and often presents glazed patches. In many cases the bowels are obstinately constipated; in others, however, there is a tendency for the bowels to be rather more active than in health.

The temperature is normal, but in severe cases may be subnormal. An elevated temperature is indicative either of the approach of an intercurrent inflammatory affection or the setting up of great cerebral mischief. The pulse in the earlier stages may be rapid and full, but in the later stages it often remains remarkably slow, even if the patient is incessantly in motion.

Prognosis.—As a rule, the prognosis of mania is favorable; the greater number of cases recovering completely or partially. Many cases recover completely, not a vestige of the affection remaining behind. In other cases, however, recovery is not so favorable. The patient is changed in his disposition and character; he is irritable and peevish, discontented; before he was an upright man; now he is given to evil ways. Or there may be permanent enfeeblement of judgment and memory. In the delusional form, the less " fixed " and the more " fleeting " the delusions, the better is the prognosis. Many cases apparently get well, relapse again, and the prognosis is worse after each recurrence. In the acute form many cases die from exhaustion during the stage of excitement. In the chronic form, if recovery does not take place within three to five years, the prognosis is most unfavorable; however, cases have been known to continue ten or fifteen and even twenty years, and then recovery take place. Those cases that do not die early, either of exhaustion or from an intercurrent affection, may continue as chronic maniacs or may pass into dementia. Ordinarily, convalescence takes place slowly, brief lucid intervals being the first indication of returning health.

Aconite.—Acute mania, attended with fear; despondency and apprehension of future calamities; apprehension of approaching death; restless, agonizing tossing about; moaning, anxious lamentations; reproaching others for trivial causes; mood peevish, irritable, malicious; anxious expression; face red and pale alternately; hands and feet cold; pupils contracted; tongue dry; pulse quick and strong.

Anacardium.—The patient seems to have two opposite wills; is inclined to laugh when he ought to be serious, and does not incline to laugh when tempted by ludicrous things.

Arnica.—Arnica is a valuable remedy in mania, especially if accompanied by involuntary discharges of a putrid odor; also in affections of the head or mind which appear slowly long after the injury.

Arsenicum.—Anxiety like that of one who has committed murder; driven from place to place; avoids meeting persons, thinking that he has offended them; terrible anxiety; face flushing up; restless glance; no rest by day or night; inclination to commit suicide.

Belladonna.—The highest degree of mania; great restlessness; he jumps on chairs, tables, and stoves; rage, madness, disposition to bite, to spit, to strike, and tear things; tears off his clothes, runs out into the street partially or wholly naked, gesticulating in a strange manner; the patient flies into a violent rage, with little or no provocation; talks incoherently; there may be constant laughing and singing; tries to compose songs, and sings merry but senseless tunes, or whistles occasionally; frequent bursts of laughter; in others dislike for conversation, constant disposition to move some part of the body, especially the hands. This remedy is indicated in all cases where there is marked cerebral congestion, or determination of blood to the head; face is red and bloated; wild eyes, with fixed, furious look; much excited; head hot; face flushed; pupils dilated; pulse full and quick.

Cannabis indica.—Hallucinations and imaginations constantly changing; imagines that he is gradually swelling; his body becoming larger and larger; that someone is calling him; that he hears numberless bells ringing; great exaltation of mind, at times with enthusiastic language; full of fun and mischief; laughs indiscriminately at every word; feels at times as if he were somebody else; seems to be in a dream, as if things were not real; begins a sentence, but cannot finish it, because he forgets what he intended to write or speak.

Coffea.—Great excitement; constant ecstasy; quick to act; lively imagination, with crowding of many thoughts and projects, which keep him awake; howls, shouts, or sulky despair; strong determination of blood to the head.

Cuprum.—Acute, furious mania, attended with full, quick pulse, red and inflamed eyes, wild looks, incoherent speech and rage; every paroxysm terminating in perspiration; mania, with biting, beating, and tearing things to pieces; full of insane, spiteful tricks; great prostration, with nervous excitability; nervous trembling, with very great acuteness and sensitiveness of all the senses.

Gelsemium.—Paroxysms of frenzy; eyes red, protruding, and ghastly; hair disheveled and a wild demeanor; talking and singing alternately; hands, feet, and head alternately hot and cold; tongue much coated; appetite capricious.

Hyoscyamus.—Talkativeness, tells everything; great inclination to laugh; lascivious shamelessness; going about naked; insulting, shouting, brawling; ungovernable rage, with exhibition of unusual strength; walks about the room at night; strikes viciously at those about him, and can scarcely be restrained; eyes staring and distorted, with spasmodic closure of the lids; face flushed, teeth clenched; foaming at the mouth; constriction of the throat; patient will neither eat nor drink.

Magnesium phos.—Constantly talking to self, or sitting still in moody silence, or carrying things from one place to another and then back again.

Nux mos.—Confusion, with strange feeling in the whole system, with pain in upper half of skull and brain, as if pressed together from above and the sides, and spasmodically seized or contracted; talks very little; confused images before his mind; forgets what he is saying in the middle of the sentence; slowness of ideas, so that he must wait before he can answer a question; uses words the opposite of what he should, to express his sensations; incoherency on attempting to express his ideas; omits letters when writing.

Opium.—Furious mania with distortion of the features; swelling of the head and face; protruding and congested eyes; bluish redness and swelling of the lips; paroxysms of rage, with rolling on the floor, and threats against his own relations, whom he does not seem to recognize; excessive wakefulness, or sleepy, but cannot sleep; constipation with meteoric distention of the abdomen.

Pulsatilla.—Religious mania; sees the devil coming to take her; the world on fire during night; fear, or rage in spells, or weeping; forgetful during lucid moments; mania with great pride; cold, haughty, too well satisfied with one's self, and not at all anxious about the future; contemptuous, constantly looking down upon people usually venerated; mania from suppressed menses.

Secale.—Stupid, wants to sleep all the time; difficult to arouse from stupor; cold, clammy sweat; offensive diarrhea.

Tarantula.—Restlessness of the hands and legs; constant movement, cannot remain in one place; screams, sings, bites, throws things violently about, springs out of bed, destroying whatever he can get a hold of; all the symptoms relieved by music.

For further indications of remedies called for in mania, as well as for the general management of such cases, compare " Treatment of Insanity in General."

Puerperal Insanity.

Puerperal insanity is technically limited to the mental disease that occurs within the first six weeks after confinement, but the sense in which we shall use it here covers the whole period from conception to the weaning of the child. Under this heading—*puerperal insanity*—we will consider: (1) Insanity of Pregnancy, (2) Insanity of Parturition, or Puerperal Insanity Proper, (3) Insanity of Lactation.

Puerperal insanity is a form of insanity which every physician is liable to meet with sooner or later. It may make its appearance as melancholia, as mania, or, in rare instances, as dementia.

Heredity plays a very important part in the causation of puerperal insanity. In some cases there is a direct transmission of the tendency, both mother and daughter suffering from puerperal insanity. One attack predisposes to another. Puerperal insanity is more frequent in first than in subsequent confinements. The later in life (especially after thirty-five) that child-bearing begins, the greater is the tendency to insanity. " Pregnancies taking place about the menopause, after years of absence of pregnancy, are especially fraught with danger." (Tuke.) Some women are insane when pregnant with a male child only, in others with a female. Prolonged suckling, followed by another pregnancy, or rapidly recurring pregnancies, may act as a cause. Difficult labors, fright, shock, grief over death of husband or child, mental worry, shame and mental distress attending the birth of an illegitimate child, desertion, and blood poisoning act as causes. Anæmia is a strong predisposing cause, and may be constitutional or consecutive to hemorrhage or prolonged lactation. The administering of an anæsthetic during labor has been given as a cause.

INSANITY OF PREGNANCY.

Insanity of pregnancy occurs specially at two periods—first, before the fourth month, and second, in the later months of gestation.

It may take the form of mania, but, as a rule, the symptoms are of a more or less melancholic type. It may show itself as mental depression or mental apathy. She becomes strange in manner; is negligent of her personal appearance and home duties; she is sleepless, restless, suspicious; morbid fears of various kinds take possession of the mind; a fear that some evil is going to happen; that she will not get over the pregnancy; that the child will be too large to be born; that there is some bodily ailment present, from which she will not recover; takes a dislike to her husband—believes that he is unfaithful to her, that he is going to abandon her, that he is trying to poison her; sometimes there is an aversion to the other children. In other cases, where it assumes more of the maniacal form, she becomes restless, violent, destructive, accusing herself of unfaithfulness; has hallucinations of sight and hearing—sees faces at the windows, hears voices outside of her room. Other cases may be emotional, quarrelsome, noisy, silly.

Those cases in whom the insanity makes its appearance in the earlier months of pregnancy are more favorable than those in which it does not appear until the later months, for it frequently passes off with the "morning sickness," or at the coming on of the so called "quickening" (which generally occurs between the fourth and fifth months), and the patient passes through the puerperal state undisturbed. In rare instances recovery takes place before delivery, but in most instances at the time of confinement or soon after; while in other cases parturition seems to exercise no influence whatever on the course of the disease; and in other cases it seemingly aggravates the mental condition, the case assuming a more severe form, and may even terminate in dementia. Many cases have similar attacks with each succeeding pregnancy, while in other cases there is never a recurrence of the attack.

INSANITY OF PARTURITION, OR PUERPERAL INSANITY PROPER.

True puerperal insanity may assume the nature of mania, melancholia, or dementia, but mania is the form most frequently met with. It may develop within the first few days after confinement, especially at the time of the milk fever. Over one-half of the cases develop within six to eight days, and over three-fourths of them within the first fourteen days. The attack may appear quite suddenly, or come on gradually. She becomes restless, sleepless, anxious, irritable, peevish, ill at ease; or she is afraid that she is going to lose her reason; or she becomes self-absorbed, dull, stupid; is negligent of her child, taking little or no notice of it, or may take an aversion to it; may take a dislike to her husband and relatives; complains of unpleasant smells, of her food, and refuses to eat; her eyes are brilliant; she seems to have no sense of exhaustion. As the attack of mania becomes more fully developed, she becomes more loquacious, chattering incessantly, and her talk becomes less and less connected—more incoherent; singing, swearing, and using the most foul, filthy, and obscene language; amorous and lascivious actions; all considerations of decency and propriety are cast aside; she becomes dirty and filthy in her habits; she may become violent—destroy her clothes, and has to be held in bed; she may attempt suicide—tries to throw herself out of the window; tries to kill her baby; she may have hallucinations of sight and hearing—sees faces on the wall, thinks that people are whispering scandal about her; has delusions and illusions; believes that they are going to take her husband or her child away from her; that she is the Virgin Mary, etc.; mistakes the identity of the people about her; calls her friends by other names, and strangers by the names of her friends.

Savage calls attention to an acute form of mania (mania transitoria), which may suddenly come on during the second or third day after delivery. The patient has a flushed appearance; great restlessness; eyes brilliant; full pulse; suddenly becomes wild and delirious, with hallucinations, during which she may kill her child and be quite unconscious of the act which she has committed. This state may pass off as rapidly as it came on, or there may be a temporary relief from the mental disorder, which may recur, to run the ordinary course of puerperal insanity.

Melancholia may be the form of insanity from which the patient suffers. Melancholic symptoms generally, but not always, come on later after delivery than attacks of mania.

The onset of the disease is similar in every respect to that of mania—restlessness, sleeplessness, anxiety, dread, etc., and in addition there are developed symptoms peculiar to the melancholic conditions, such as that she is eternally lost; that her bowels are completely stopped up, and that it will do her no good to eat, for nothing will pass through; that she is persecuted, etc.; also there may be developed suicidal tendencies, and she may not only try to destroy herself, but her children; at the same time there may be developed tendencies to resist every attempt to do anything for her. This condition will eventually pass into melancholia with stupor.

INSANITY OF LACTATION.

This is a form of insanity coming on during the nursing period, and is met with more frequently among the poor than the well-to-do; in women who have had several children, and at the same time the system being poorly nourished, on account of not having the sufficient means of life; in women who, in addition to the continuous physical strain of nursing the child, have all the cares and worries of a large family. These cases of lactational insanity vary greatly in form and degree of mental disturbance, but they are nearly all melancholic at some period of the attack. The symptoms may come on at any time after delivery, from six weeks up to one year or more.

The woman becomes anæmic, pale and thin; she is in an exhausted condition, tires out easily; great depression of spirits, and want of energy; or she is peevish and irritable, and takes no interest in things about her; she is subject to palpitation and shortness of breath; she becomes subject to headaches, or " queer feeling at the top of head," dizziness, noises in the ears, and cannot sleep well; loses her self-control; sees strange figures in the room; imagines that her husband has deserted her, or that he or the neighbors are plotting against her; that people are trying to mesmerize her; refuses her food; and rapidly loses strength, until her case is rendered serious from simple exhaustion. There may be suicidal tendencies, and it is in such cases that infanticidal ideas as well as acts are usually met with. Some cases may assume the maniacal form from the start; or again, cases beginning as melancholia may later pass into the maniacal form. She becomes restless, wild, excitable, erratic; has delusions, hallucinations, etc.

In *all* these types of puerperal insanity the milk may be present or absent; the lochial discharge may be present or absent; in either case the *presence* or *absence* of the milk or lochial discharge apparently having no influence on the course of the disease.

A peculiar feature in nearly all of these cases of puerperal insanity is that as improvement begins they pass into a state of discontent; they accuse everyone of being unkind to them. This condition passes off as improvement still further advances, but occasionally, however, it may become permanent.

Prognosis of All Forms of Puerperal Insanity.—The prognosis of puerperal insanity is the most favorable of all forms of insanity. In mania the prognosis is more favorable than in melancholia. According to Gooch, mania is more dangerous to life; melancholia to reason.

A few cases recover within six weeks, others from three to six months, but the greater majority recover within the first nine months; while in melancholia the duration is much longer —six to twelve or even eighteen months, many of the cases passing into chronic melancholia, others into a hopeless demented condition. Cases of recovery, however, have been reported where they had been apparently in a hopeless condition of dementia for two or three years.

Many cases die of exhaustion during the stage of excitement. others from some intercurrent affection. When recovery takes place, it is usually gradual. This is more favorable than if the patient recovered suddenly as if awakening from a dream, as sometimes occurs in other forms of mental disease. Sudden recoveries are not so apt to be permanent as gradual ones.

Treatment of All Forms of Puerperal Insanity.—Puerperal insanity is the one that should receive *home* treatment. Rarely, indeed, is it absolutely necessary that the patient should be sent to an asylum, unless the financial circumstances of the family are such that she cannot receive the proper treatment at home. If the family is in poor circumstances, and cannot get good nursing or medical attendants, or if the strain and responsibility is more than the relatives can bear, the sooner that she is sent to an asylum the better it will be for her. There are many reasons, however, why home treatment should be resorted to, the chief ones being the hopeful prognosis and speedy termination, as compared with other forms of insanity; besides, there is the fact that the child or children (and, for that matter, all the family) will suffer socially, for when one member of the family, especially the mother, has been in an asylum, it gives the " friends " and " neighbors " something to talk about for generations to come.

If the patient is to be treated at home, a room that can be well ventilated, and one that is bright and cheery-looking, should be chosen, and the patient practically isolated from the rest of the family. There should be two well-trained nurses placed in charge, one for the day and the other for the night. If, however, they are not able to stand the expense of two nurses, keep the night nurse, and place some trusted female member of the family in charge during the day. Only a very few of the most trusted friends should be permitted to visit her, and especially should the children be kept out of her sight. If she has suicidal tendencies, she should not for a moment be left alone. Nothing that can be used as an instrument of violence, such as knives, scissors, razors, etc., should ever be left within her reach; cords, handkerchiefs, or articles of dress by which strangulation might be effected should not be allowed her under any pretense whatever.

Refusal of food is one of the most dangerous symptoms, and one for which steps will have to be taken at once if the life is to be saved. (See article on forced feeding.) *Feed freely* and *feed often*. In no other disease is this injunction to be so strictly carried out; let her alone, and she dies or becomes demented. As Clouston says, "She needs to be fed at once, *nolens volens* (by means of the rubber nasal tube if she will not take it otherwise), with plenty of milk and eggs, and soup and wine, and this needs to be repeated every hour or two."

Morphia and other opiates should be left severely alone, for they not only dry up the secretions, but also increase the apathy for food.

The bowels should be kept acting regularly, and frequent bathing with alcohol and water is highly beneficial, as by this means the skin is kept clean and free from noxious emanations. Baths should be frequently used as soon as the patient is strong enough, and as soon as she is able she should be taken out in the fresh air and given moderate exercise, and this increased daily as she grows stronger. When she is strong enough, it is usually better to send her to the country, or to the mountains, or, what is more preferable still, to the seashore. Change of scenery, plenty of fresh air, and outdoor exercise are valuable adjuncts.

Orificial measures will prove of more value in the greater majority of these cases than any other line of treatment. There should be a thorough dilatation of the rectum and urethra, curetting of the uterus, and particular attention should be paid to the clitoris. Orificial treatment has the power to arrest and practically cure the worst case of puerperal mania that can be produced.

Actea racemosa.—Great mental depression, with suicidal mood; desire for solitude, or to wander from place to place; answers questions hurriedly and evasively; declares she has been poisoned; suspicious of everything, would not take medicine if she knew it; declares she will go crazy; she has a dread or fear of something about to happen, and this haunts her from day to day; sleeplessness; top of the head feels as if it would fly off; worse going up stairs; dull pain in the occiput, with shooting down the back of the neck.

Alumina.—She makes mistakes in speaking, using words not intended; dread of death, with thoughts of suicide; a desire to kill herself with a sharp weapon; seeing blood on a knife, she has horrid ideas of killing herself, though she abhors the idea.

Agaricus.—Talks incoherently; passes rapidly from subject to subject; falls into a delirium as with high fever; her disposition changes quickly from gayety to despondency, and *vice versa;* sings, talks, but does not answer questions; fearless, menacing, mischievous frenzy; frenzy causing her to assail and injure herself; strength greatly augmented.

Anacardium.—Everything appears as if in a dream; loss of memory; forgets everything she has seen; or she remembers only with difficulty; she is deficient in ideas, and soon loses the subject without being aware of it; has a fixed idea that the mind and body are separated; that her husband is not her husband, her child not her child; now she fondles them and again pushes them away; strange temper, she laughs at serious and is grave over ludicrous occurrences; feels as though she had two wills, one commanding to do what the other forbids; in one ear a devil, in the other an angel, which prompts her to do murder or acts of benevolence; has an irresistible desire to curse and swear; uses profane language, swears, thinks herself a demon.

Arsenicum.—Restlessness, cannot rest anywhere, moves from place to place; wants to go from one bed to another; vexed and dissatisfied at everything; the least noise or light angers her, she is so sensitive to external impressions.

Aurum metallicum.—Looks on the dark side of life; weeps and prays; thinks she is not fit for this world; longs for death; strong inclination to commit suicide; desperate, desires to jump from a height; very unhappy; continued thought of suicide; disposed to shun people; feels hateful and quarrelsome.

Belladonna.—Mania, at one time merry, again would spit and bite at those around; disposed to strike and tear things; great loquacity; foolish talk; laughs without cause; speech rapid and hasty, often uttering inarticulate, confused sounds; loud laughter, singing and whistling; conversation lascivious; grinding of the teeth; face red, looks wild and staring; pupils dilated, pulse small and very frequent. In other cases the patient is melancholy, sad and dejected; indifferent to everything; nothing makes an impression upon her; absent minded and forgetful; likes to brood in silence.

Calcarea.—Low spirited and depressed, with weeping and despair of life; apprehensive mood, as if some misfortune were about to happen; fears that something sad or terrible will happen; very peevish and easily vexed; takes everything amiss; feels as if she would like to run up and down and scream; she thinks and talks of nothing but murder, fire, rats, etc. Calcarea is especially useful in insanity of lactation, especially where there has been excessive lactation, causing a general debility. The patient complains of great weakness and lassitude and cold hands and feet. Associated with these symptoms there are hectic and sweats, and the complexion is pale and sickly.

Conium maculatum.—Discouraged, despondent, and dissatisfied with herself and her surroundings; she feels peevish, vexed, and easily put out about trifles, and is easily moved to tears; extreme want of memory; dullness and difficulty in understanding what she reads and what is said; very much excited; passionate, domineering, quarrelsome; scolds and will not to be contradicted; confused feeling in the head; often sits lost in thought; headache and vertigo; buzzing and roaring sounds in the ears.

Gelsemium.—Desires to be let alone; irritable, sensitive; depression of spirits, and anxiety or solicitude about the present; cataleptic immobility, with dilated pupils, closed eyes, but conscious. Gelsemium is also called for in the maniacal form, where there are paroxysms of frenzy; eyes red, protruding, and ghastly; hair disheveled and a wild demeanor; talking and singing alternately; hands, feet, and head alternately hot and cold; tongue much coated; constipation; appetite capricious.

Ignatia.—Senseless staring at one object, with sighing and moaning; indifference to things she loved best; sits alone and weeps; remorse about imaginary crimes; intolerance to noise; great inclination to have fixed ideas; suicidal thoughts; seeks constantly to escape to drown herself; at times rages and tears her clothes, and can scarcely be restrained.

Natrum mur.—Absent minded or distracted while talking; does not know what she ought to say; easily makes mistakes; despairing, hopeless feeling about the future; melancholia with frequent weeping; pain in the occiput; chilliness; restlessness; melancholia during pregnancy; fears that the child will be marked; constant dwelling on past events; weeping if looked at. The patient is anæmic, and is troubled with palpitation and constipation.

Nux vom.—Oversensitiveness to impressions upon the senses; cannot bear reading or conversation; irritable, angry disposition; wishes to be alone; inclined to find fault and scold; very much inclined to violently reproach others with their faults; an insane desire when alone with her husband, whom she adores, to kill him; inclined to commit suicide, but is afraid to die; despondent and buoyant alternately; chilliness; sleeplessness; abdomen bloated; constipation, with frequent, ineffectual urging at stool.

Pulsatilla.—Restless and changeable; easily moved to tears or laughter; well one hour, miserable the next; silent mood; inclined to silent grief with submissiveness; sad, bursting into tears very easily; can hardly tell her symptoms from weeping; great despondency and fear of losing her reason, or that she might commit suicide; full of anxiety; forebodings of impending disasters; pale, earthy complexion; no appetite, much thirst; palpitation of the heart; limbs feel as if asleep; she is weak and weary; cannot sleep at night on account of fear and dread.

Rhus tox.—Melancholia; ill-humor and anxiety, as if a misfortune would happen; or as if she were alone, and all about her were dead and still; or as if she had been forsaken by a near friend; symptoms all worse in the house, better walking in the open air.

Sepia.—Great sadness and frequent attacks of weeping, which she can scarcely suppress; every few minutes inclined to cry without knowing the cause; sad about her health and domestic affairs; discontented with everything; dark foreboding in regard to the future; fears she will starve; aversion to her family and even for her child; great irritability from the slightest cause; very easily affected; violent bursts of anger, with furious gestures; confusion and throbbing in the head; constant pains in the occiput, worse lying; frequent pain in the back and hips, extending down to the legs and feet; flushes of heat over the body and face.

Stramonium.—Rage; unmanageable; laughing, rolling, and creeping round in bed; unable to stand on her feet; pupils wide open and insensible to light; wants to kill people and herself; uncontrollable fury; can scarcely be restrained; flies at people; strikes and endeavors to seize them; talks incessantly about foolish things which nobody can understand; sits down; rises up; kneels or takes other queer positions.

Veratrum album.—Mania with desire to cut and tear everything, especially clothes, with lewdness and lascivious talk; convulsions, with violent cerebral congestion; bluish and bloated face; protruded eyes; wild shrieks, with disposition to bite and tear; complete sleeplessness; eats nothing; melancholy: head hangs down; brooding in silence; religious melancholy or nymphomania, with desire to embrace everybody, even inanimate objects; much thirst for very cold water; constantly craving cool and refreshing drinks.

Verat. vir.—Sleeplessness; silent; suspicious; will not see her physician; he seems to terrify her; fears being poisoned; can hardly be kept in her bedroom. Especially indicated in puerperal mania.

In treating a case of puerperal insanity we have the cheerful thought that we are dealing with the most hopeful of all forms of insanity as regards a complete cure, and that with a little time and patience, in addition to our chosen remedies, we will see our patient resume her household and family duties and take her place in society as though she had never been mentally ill.

Dementia.

This is a term used to indicate a state or condition of mental failure or weakness, due to disease (functional or otherwise) or decay of the brain.

It is always an acquired condition, and as such is to be distinguished from *amentia*, a congenital condition where the brain development is arrested before birth, or in early childhood, thereby resulting in idiocy and imbecility. In other words, *dementia* signifies *acquired* enfeeblement of the mental faculties in individuals who have been formerly mentally healthy; while *amentia* signifies a *congenital* enfeeblement, due to fetal or infantile arrest of development. The principal types of dementia met with are: (1) Primary Mental Deterioration; (2) Secondary Dementia; (3) Organic Dementia, or Paralytic Insanity; (4) Senile Dementia; (5) Paralytic Dementia, or, as it is generally termed, General Paralysis of the Insane.

There are still other types of dementia, such as epileptic dementia, following severe and rapid epileptic attacks; syphilitic dementia, the result of syphilitic poisoning; alcoholic dementia, following long-continued and excessive use of alcohol. All the symptoms of these types correspond in the main to those of the other types to be described, so that it will not be necessary to take them up separately.

PRIMARY MENTAL DETERIORATION, OR PRIMARY DEMENTIA.

This is a form of mental weakness coming on without having been preceded by another form of mental disease, such as mania, melancholia, etc.

It is essentially a disease of youth, being rarely seen in persons beyond thirty years of age. It occurs more frequently in children whose powers are overtaxed at the time when the process of development is going on, and when nutrition has not only to repair tissue wasted, but to form new tissue. It may follow severe and long-continued fevers, such as typhoid, pneumonia, etc. It may be due to direct injury, such as a blow on the head. Other causes are fright, shock, terror, and anxiety; also exhaustion due to sexual excitement in some form or another.

The mental weakness may exist in every possible degree, from a slight to a complete loss of memory. In many of these cases the only symptoms noticeable are that the patient is not as bright mentally as he formerly was, and cannot do the same amount of work as accurately and as easily as formerly, and is unable to fix his attention on anything. He becomes confused easily, loses confidence in himself, and has no energy; becomes apathetic, indolent, and at times emotional; or he is silent and self-absorbed, difficult to rouse, and answers in monosyllables; or not at all when spoken to. In a more severe form the patient is stupid, takes no notice of anything or anyone, will not speak when spoken to, or sits in motionless stupor, or wags his head, or performs some silly, automatic motion. The patient acts sillily, talking and laughing to himself, or he is erratic in his speech, or his speech is incoherent. The countenance wears a perplexed or vacant expression; he may take to masturbating; becomes negligent in his habits; does not obey the calls of nature or take any notice of them at all. In fact, they have to be fed, washed, and dressed like young children; they cannot do anything for themselves. In many instances it is only possible to distinguish between a case of primary dementia and one of melancholia with stupor by close and long-continued watching. In cases of dementia that recover the memory is a blank during the time of their illness, while in melancholia with stupor they retain a memory, to a greater or less degree, of events that transpired during their illness. This form of dementia may be transitory or persistent, and is the only form of dementia in which treatment avails much.

SECONDARY DEMENTIA, (TERMINAL DEMENTIA).

This is a form of mental impairment following mania, melancholia, and other insanities. It is this class of patients that constitute the greater majority of the inmates of the asylums. Many of them are useful in doing the simpler and more mechanical works of an asylum; but the greater majority of them sit or lounge around, requiring to be fed, conducted to the water-closet, dressed, and put to bed like children. The mental impairment in this class of individuals varies from a mere loss of memory (usually of recent events) or of reasoning power to nearly complete extinction of the mind. The loss of memory for recent events is a characteristic feature in many dements; many of them being able to converse only on subjects which transpired years ago.

Some of the patients sit or stand in one place all day, making grimaces or indulging in some rhythmical movement, as shaking the head, rocking backward or forward, etc., or in constantly saying a particular phrase, whispering to themselves, taking no notice of anyone or anything. Many of them are very destructive, tearing up their clothes, beds, etc. Many of them swallow anything they can get hold of, even their own excrement. Many of the "secondary dements" may at times become suicidal, destructive, and dangerous, requiring special care for a time. Many of these patients require to be fed by force; others will eat by placing them at the table and putting eating utensils in their hands. In many of them the appetite is enormous; they bolt their food, and have to be carefully watched to avoid being choked. In some cases the appetite and assimilation become normal, or nearly so, and not unfrequently the patients become very stout.

The prognosis is, as a rule, death in a longer or shorter period; recovery, of course, is impossible, many dying from intercurrent diseases, chiefly pulmonary affections. Being an incurable affection, treatment can only be directed to the nourishment of the patient, keeping him suitably clothed, and by careful attendance to promote habits of cleanliness.

ORGANIC DEMENTIA, OR PARALYTIC INSANITY.

This is a form of mental weakness resulting from gross organic disease of the brain, such as cerebral hemorrhage, embolism, thrombosis, atrophy, chronic derangement of the brain, etc.

Accompanying the motor and sensory symptoms (paralysis and anæsthesia) there are developed certain mental symptoms; at first a mental depression, then a mild exaltation and emotionalism. He becomes childish, memory imperfect, does not recognize his own name; speech becomes incoherent. As the mental deterioration progresses he becomes stupid, helpless, and eventually passes into a complete stage of dementia.

SENILE DEMENTIA.

Senile dementia differs from the senility of old age in that in senility of old age the failure of the mental power is accompanied by a general and gradual decline of *all* the functions of the body; while in senile dementia some of the mental faculties are exaggerated, perverted, or transformed; in others there is a rapid decay and extinction out of all proportion to the gradual physiological decay of the physical system.

The first symptoms observed are: A failure of memory, particularly with regard to recent events, while those of an earlier period of life may be well remembered; irritability of temper;

restlessness; sleeplessness; lack of self-control; morbidly suspicious; thinks that everyone is trying to defraud or rob him.

Not unfrequently the first symptom may be a craving for alcoholic stimulants, or a reappearance of the sexual desire. This reappearance of the sexual desire may at first manifest itself in lascivious speech and gesture or the patient may expose his genital organs to persons of the opposite sex. With the progress of the disease these acts are more and more shamelessly committed. He may make attempts to rape young girls or children. He proposes marriage to all his female acquaintances. Many absurd and ridiculous marriages have been contracted by these old dotards. The union of " May " and " December," or the marriage contracts formed in some instances by old men with their servants or mistresses, are examples of this class. As the disease progresses the mental enfeeblement becomes greater; he loses his way on the street, does not know his home, his age, his wife, or how many children he has or their names; he becomes coarse and vulgar and filthy in his habits; his appetite is voracious; may be subject to delusions. These cases eventually pass into the final stage of dementia—profound stupidity, memory a blank. Out of true senile dementia there can be no issue but death; death ending the scene usually either with apoplectiform symptoms or with those of a gradual and general paralysis.

PARALYTIC DEMENTIA, GENERAL PARALYSIS OF THE INSANE (PARETIC DEMENTIA).

This is a disease that should possess more than usual interest for the student and general practitioner; not only from the fact that asylum statistics go to show that only about one in every ten cases that have been sent there suffering from this affection has been correctly diagnosed, but also from the fact that in no other form of insanity are the business interests of the patient and also of his associates so jeopardized or so many fortunes run through with as in paralytic dementia. The reason of this is that the disease occurs chiefly in business men, and on account of its being so insiduous in its approach and the development of peculiar reckless and extravagant tendencies; the fortunes of the patient and of all persons associated with him in business are wrecked even before insanity is suspected.

Paralytic dementia is a chronic and progressive form of dementia, and associated with the mental symptoms there are certain motor symptoms, such as ataxia, and progressive incomplete paralysis of certain muscles, the paralysis gradually extending over the entire body. Clouston defines paralytic dementia as: " A disease of the cortical part of the brain, characterized by progression, by the continued presence of mental and motor symptoms, the former always including mental enfeeblement and mental facility, and often delusions of grandeur and ideas of morbid expansion, or self-satisfaction; the motor deficiencies always including a peculiar defective articulation in words, and always passing through the stage of fibrillar convulsions, inco-ordination, paresis, and paralysis; the diseased process spreading to the whole of the nerve-tissues in the body; being as yet incurable, and fatal in a few years."

Causes of Paralytic Dementia.—Paralytic dementia is a very common affection, and is met with more frequently in robust, active business men, men subject to great mental strain. It is met with more frequently in males than in females. It occurs chiefly between the ages of thirty and fifty, although it may occur before or after these periods; it scarcely ever appears after sixty and never after sixty-five. Sexual excess is given as a cause, or in many instances it may be construed as one of the earlier symptoms, rather than the cause of the affection. Alcoholism, syphilis, injury to the head, anxiety, worry, and pecuniary troubles may act as causes. It may arise from pregnancy and childbirth, without any other apparent causes. Pederasty is sometimes an early sign of paretic dementia. It is not hereditary, in the strict sense of the term.

Symptoms.—Prodromal symptoms may precede the initial signs of the disease months or even years. The prodromal symptoms may be either mental or bodily. He is sleepless, complains of headache, with a sense of weight and confusion in the head, feels as if the top of the head would rise, and associated with this a slight degree of vertigo; may be subject to obstinate attacks of neuralgia or attacks of vomiting; there is lack of former mental activity and energy; there is a painful anxiety regarding the most trivial circumstances; he is irritable, quarrelsome, nervous, depressed, and impatient—flies into a passion on the least provocation; he is absent-minded; becomes careless in his dress and personal appearance; forgets to button his clothes; neglects all habits of order and neatness; he is unpunctual in his business hours and forgets his appointments. There is a tendency to fall asleep in the middle of the day, during business hours, and especially after meals, while at lectures, church, etc. (however, all individuals who fall asleep while at church should not be classed as dements).

Fulgurant and stabbing pains may be met with in the spinal type of the affection. As the disease progresses, mental deterioration becomes more and more marked. He becomes changed morally; commits dishonest acts or petty thefts; becomes jealous, suspicious, and thinks everyone is against him; he neglects his business, and is constantly changing his plans or his business; he speculates recklessly, has extravagant ideas about what he is going to do, squanders his money in useless ways, and buys unnecessary articles in large quantities. Savage says a man who buys a dozen broughams, or twenty parrots, is probably a general paralytic. As a further illustration of this tendency to extravagant expenditure, I would cite the following instance: A gentleman in whom paralytic dementia had not been suspected was at one time sent after a can of oysters, and he ordered home half a wagon-load; another time, when going to purchase a pair of socks, he ordered fifty pairs to be sent home. Another case at one time ordered home four hundred fire extinguishers. In some instances the patient is restless and disposed to wander about; another will boast of his strength, or his amours with the serving-maids before his wife and children; he visits low dives and drives about in a carriage with "fast" women; another is constantly writing and sending postal cards to officials and persons of note.

Soon the motor symptoms make their appearance; the first of these are *tremor of the tongue and lips*, with hesitancy of speech; he clips his words; speech becomes indistinct and difficult. Temporary loss of speech (aphonia) followed by tremor of the tongue and lips and hesitancy of speech may be the first motor symptoms. Dr. J. Criton Brown says that constant tremulous agitation of the palpebral and great zygomatic muscles is pathognomonic of the earlier stages of general paralysis. As the disease progresses, other muscles become involved. This tremor renders the movements irregular, awkward, and constrained. All the more delicate movements, such as writing, sewing, dancing, playing the piano or other instruments, gradually become impossible. "In the earlier stages, when the tremor in the hand is slight, it can be best detected by having the patient extend the arm at full length, supporting the fingers upon the palm of the examiner's hand, when a delicate muscular tremor will be made evident." (Gray.)

Still later all these symptoms become intensified; a pronounced coarse tremor is observed in the hand when holding it out; writing becomes a mere scrawl, words are clipped, erased, or repeated, and he is unable to follow the lines in writing. Sooner or later, the lower extremities become involved; a slight change in his gait will be observed. He stumbles if the ground be uneven; soon an ataxic gait is developed; he walks unsteadily and shaky. Sooner or later the so called delusions of grandeur are developed—the stage of exaltation. He imagines that he is the most powerful and richest man in the country; he is usually generous with his imagined riches, spends lavishly, makes magnificent presents, and forms great schemes. The delusions are fleeting; he soon forgets one delusion and passes to another; he may claim to have thousands of dollars to-day, hundreds of thousands to-morrow, and millions the next day; he is a colonel to-day, a general to-morrow, a king the next day, etc.; he is usually good-humored and self-confident; when asked how he is getting along, almost invariable answers, " Never was better in my life," or " First rate," when, in fact, he cannot utter the words distinctly or can hardly stand alone; says he can walk, work, or do business as well as he ever did. When shown the absurdity of his delusions, he does not try to reason, but simply reiterates the same statement. He is willing to fight or run a race with anyone. In a later stage all these delusions disappear, and he passes into the final stage of dementia. Some of these cases, however, are ill-natured and distrustful. As the mental weakness increases, he loses all moral restraint, masturbates in the street, attempts rape on children, attacks women on the street, forces his way into the house of an acquaintance and tries to cohabit with the wife, or marry the daughter on the spot. In the final stage, however, the sexual desire is entirely lost.

The motor symptoms keep pace with the mental deterioration; the speech becomes more hesitating; the voice becomes monotonous, and incoherence soon becomes marked; the gait becomes unsteady, like that of a drunken man; the legs are thrown wider apart to increase the basis of support; his knees are unsteady and there is a jerky, irregular movement of the legs; the feet are dragged, and he is apt to stumble over small things; he cannot turn round quickly without risk of falling; later on he stumbles and falls frequently, and cannot walk without support. Not every case of general paralysis begins in the manner just described.

In some cases the first symptoms are those of melancholia; he is mentally depressed, silent, and abstracted; refusing his food, he loses flesh; he becomes negligent of his appearance and is sleepless; or he has delusions that he is dead; that some part of his body is changed; that his limbs are made of glass, iron, etc.; he may develop suicidal tendencies. This melancholic condition may gradually clear up, and the patient passes into the stage of exaltation and afterward traverses the successive stages of general paralysis. In other cases, however, there may not be any remissions of the melancholic symptoms, the patient passing from the melancholic stage into that of extreme mental weakness and general paresis.

In other cases mania may be the first or one of the earliest symptoms of general paralysis—the initial stage consisting of mania with exaltation; he imagines he is possessed of unbounded wealth, and is benevolent in the extreme; he is restless, noisy, violent, and destructive, tearing everything within reach; he may commit violent and fatal assaults upon anyone who comes near him. The mania of the paretic dement is the wildest and most fearful of all the forms of mania. The patient continually raves until the attack begins to subside. The maniacal attack may last a few hours, a few days, or even months.

In a few cases (sometimes termed the spinal type) symptoms of locomotor ataxia (*i. e.*, sclerosis of the posterior column of the spinal cord) may exist long before general paralysis is detected. There may be present, to a greater or less degree, an ataxic gait, absence of knee-jerk, inability to stand with the eyes closed, nystagmus, Argyll-Robertson pupil (*i. e.*, pupils contract for accommodation, but not to light), and atrophy of the optic disks.

Other cases may present the symptoms of *spastic paraplegia* (*i. e.*, sclerosis of the lateral column of the spinal cord). The gait is peculiar and spasmodic; the foot no sooner touches the ground than it is suddenly jerked up again; the reflexes are exaggerated, foot-clonus being present at times. In rare instances cases may develop the paralytic symptoms first, but, sooner or later, the mental symptoms make their appearance. However widely the early symptoms in different cases vary, the later are similar to a remarkable degree; all ending in dementia, sooner or later.

Remissions may occur during the course of the disease, varying in length from a few months to a year or more. In some instances these remissions may be so well marked as to simulate recovery. It is extremely rare, however, for the tremor of the lips and tongue to remit after once being developed. A remission rarely ever occurs more than once in any one single case.

A symptom that is of great diagnostic value in paretic dementia is *inequality of the pupils.* It is common at some time or other during the course of the disease to observe this pupillary inequality; sometimes it is one pupil, sometimes the other, that is dilated or contracted. The pupils that are contracted one week may be dilated the next, and *vice versa.* The pupils may be at one time eccentric and at another time irregular in outline. In the later stages the pupils may be dilated.

The pupils may be extremely small—pin-point pupils. Savage says that in one group of cases (namely, those associated with the changes in the lateral columns of the cord) the pupils are frequently reduced to pin points; and if he meets a case with such smallness of pupils, he expects a further development of general paralysis. Spitzka says that an extreme dilatation of both pupils, following pin-hole contractions, is an indication of rapid decline.

In those cases associated with locomotor ataxia the pupils may be perfectly immobile, or excessively sluggish in reaction to light, or may extend rapidly to accommodation (Argyll-Robertson pupils). Many of these cases of paretic dementia will be found to be *color-blind.*

A large proportion of those suffering from general paralysis are, during one or more of the stages of its progression, subject to apoplectiform or epileptiform seizures. In fact, a convulsion may be the initial sign of the disease, the symptoms of mental failure and paresis dating from a fit. After every convulsion, mental failure and general paresis is more pronounced. A convulsion may be general or may affect one side; they may last a few moments, a few hours, or even days; they vary in their degree of severity from the twitching of some isolated muscle or group of muscles to that of *grand mal* or true epilepsy; they usually become more frequent as the disease progresses; consciousness may or may not be lost.

Very rarely does a case run its whole course without having, in some stage or other, a convulsion. The cutaneous sensibility in the earlier stages may be increased, or later it may be slightly diminished, or still later, it may be almost entirely abolished; burns, wounds, etc,, may occur and the patient not be conscious of pain. The skin may be flabby and greasy, or of a tallowy nature, or it may be thin and dry.

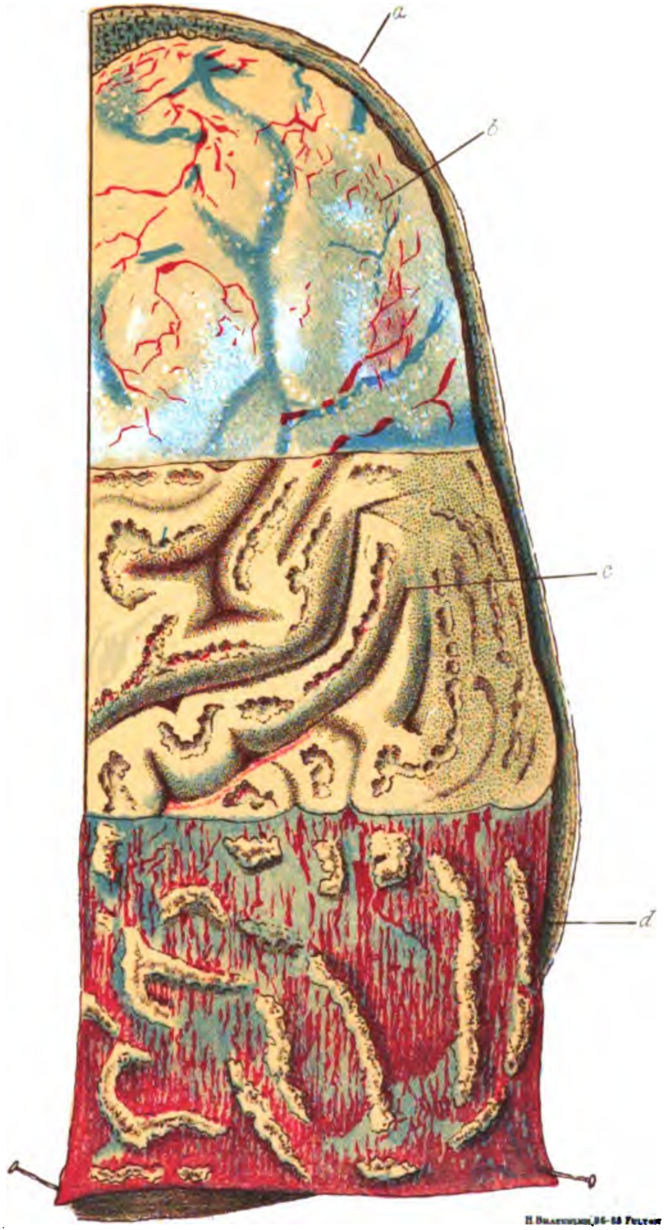
Trophic disturbances are well marked in the later stages; bed-sores may rapidly form, and in some instances run a fatal course within a week. There is a tendency to the formation of large abcesses from slight bruises.

An affection met with quite frequently in the later stages is what is termed hematoma auris (bloody tumor of the ear, insane ear). Hematoma auris occurs occasionally in chronic melancholia, chronic mania, and, in rare instances, may be met with in sane individuals. It consists of an effusion of blood or of bloody serum between the cartilage of the ear and its perichondrium, and may vary in size from a small, minute swelling up to that of a hen's egg. The lobule of the ear is never affected, the lesion being entirely limited to the cartilaginous portions of the auricle. It may run its course in a few weeks and gradually disappear, or it may rupture and be followed by shriveling and persistent deformity of the ear; but if the rupture does not occur, it may remain as a hard, solid swelling. "Whenever hematoma auris once occurs, however, the ear never regains its normal and original shape and configuration." (Pietersen.)

The appetite, which was poor in the earlier stages, becomes normal or even voracious as the disease progresses, and the bodily weight is rapidly increased; but in the last stage he may waste rapidly, becoming thin and emaciated. During the last stages the patient passes into complete dementia. He becomes filthy and dirty; has to be washed and tended like a child; not only has he to be fed, but his food has to be pushed back into the mouth; swallowing becomes difficult and dangerous; he is unable to retain his urine or fæces by night or day; he may become blind and deaf. Complete mental and physical failure closes the history of the disease.

Pathology.—General paralysis of the insane is due to a diffuse meningo-encephalitis, causing general pressure upon and irritation of the cerebral cortex. In cases dying early, during the acute stage, the only abnormal condition observed may be an hyperæmic condition, but in the later stages there are well-marked changes. In the advanced stages a necropsy will reveal the following pathological changes. The skull is generally thickened and the diploë intensely congested; in rare instances, however, the skull may be abnormally thinned and softened in consequence of atrophic changes. The dura mater is generally thickened and more adherent to the skull than in health, especially so in the frontal regions; it is sometimes discolored and darker than usual. "In a few cases there is found lying between the dura mater and arachnoid a false membrane, varying in thickness from a film to a quarter of an inch, in extent from one or two small patches to a covering of both hemispheres above and below, being usually thickest over the vertex." (Clouston.) This membrane is the result of a pachymeningitis. Sometimes there is found between the dura mater and arachnoid several ounces of a dirty brownish-looking fluid. There is generally more or less opacity of the arachnoid. The pia mater is thickened, vascular, and tough in consistency, its meshes being infiltrated with serous fluid. It is generally found adherent to the brain surface in spots, and when it is removed, the superficial layers of the cortical substance are torn away with it and may be seen adhering as irregular patches to its inner surface. (See Fig. 83, Plate XVIII.) The convolutions from which those patches have been removed present an irregularly eroded, and usually a more or less reddish, appearance.

In some instances the depth of the gray matter comes off down to the white substance beneath. The adhesions occur most frequently over the frontal, parietal, and temporo-sphenoidal lobes, with occasional patches scattered over the rest of the brain. The gray matter usually has a shallow, faded appearance, and is softened and watery, or may become more or less sclerotic, either locally or diffusely. The white substance



H. [illegible], 86-88 Fulton St. N.Y.

Fig. 83, Plate XVIII.—The Vertex of the Brain in Advanced General Paralysis. (After Clauston.) *a*, Skull, cap condensed. *b*, Anterior third of brain, as seen when dura mater was first raised, showing thickened milky arachnoid dotted over with small white spots, with the opaque turbid compensatory fluid under it, and the tortuous dilated veins, congested vessels, the convolutions showing dimly through. *c*, Middle third of brain, showing the appearance of the convolutions after the pia mater has been removed. They are congested, and the outer layers of gray substance have been torn away in irregular patches, from the most projecting part of many of the convolutions having adhered to the pia mater and having been removed with it.

The portions so removed have left ragged, eroded-looking spaces, where the gray substance looks softened, while the outer layer looks hard and opaque on its surface. *d*, Shows the pia mater stripped from middle third of brain, hanging down, concealing posterior lobe of brain, and showing the appearance of its inner surface with the portions of the convolution adhering to it. It is congested and thickened, so that, instead of being like the normal pia mater, a delicate, filmy, transparent membrane, it is a tough, spongy-looking texture.

usually presents a mottled, discolored appearance, but occasionally it presents a white sieve-like appearance. The neuroglia is almost always diseased, and usually indurated. "The convolutions are atrophied, and tend to be wedge-shaped and to lie loosely together; the wasting being most advanced in the frontal and parietal lobes, present to some extent in the upper part of the temporo-sphenoidal lobes, but invisible in the occipital lobes." * A considerable amount of subarachnoidean fluid takes the place of the wasted convolutions. In advanced stages a very frequent lesion, according to Spitzka, is cystic degeneration of the cortex, which is found both in the gray and white matter. This consists of minute cavities, varying in size from a pin's point to a millet-seed. The lateral ventricles are usually found distended with fluid, and in some instances their lining membrane presents a granular appearance—an appearance as if coated with finely ground glass. Inflammation of the arteries exists to a considerable extent, and occasionally atheromatous deposits are found surrounding them. In many cases they present a peculiarity in their conformation—they are kinked or knotted. The olfactory bulbs and tracts are usually wasted and softened. In some cases there is general wasting of the spinal cord; in others the posterior columns are chiefly affected; in others still the lateral or lateral and anterior columns. The degeneration may affect all parts of the nervous system. In fact, there is no nervous tissue that is not found diseased and degenerated in advanced cases of the disease; the facial, the tri-facial, the glosso-pharyngeal, and the sciatic nerves may be found wasted and indurated. According to Dr. J. C. Browne, in no form of mental disease (excepting the dementia of brain-wasting) is atrophy of the brain so advanced as in general paralysis. In the advanced stages of the disease there is an obvious decrease in the entire volume of the cerebral mass—a compensatory fluid filling up the spaces (ventricular, subarachnoid, and subdural) left vacant by the atrophy of the convolutions and brain generally.

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* J. C. Browne, "West Riding Reports."

Prognosis.—When the disease is in its prodromal stage, there is a possibility of checking its further progress; but when the disease has become fully developed, it progresses, invariably, to a fatal termination.

It may run its course, death ensuing within a year after the initial symptoms show themselves; but usually it lasts about three years, and in some cases even as long as eight or ten years. Death may be due to a convulsion or a series of convulsions; to lung complications; to simple exhaustion due to bed-sores; or to want of power to assimilate food.

Treatment.—In the prodromal stage, and even in the earlier stages of the affection, much can be obtained by prophylactic treatment. He should be advised to lead a perfectly regular life, keep early hours, bathe frequently, and perform moderate and regular bodily exercise, and avoid mental and physical overwork; he should be prohibited from using alcoholic stimulants and tobacco, and warned against sexual excess. The therapeutical treatment called for would in the main be similar to that for neurasthenia.

After the disease has become fully developed, the treatment is mainly careful management and good nursing. In the later stages perfect cleanliness and the prevention of bed-sores are of the foremost importance.

In the treatment of hematoma auris, which occurs very frequently in these cases, many measures have been advocated; blistering has been recommended, also opening the hematoma and dressing it surgically; but many asylum physicians have condemned both these measures, claiming that non-interference is always the best policy with hematoma. Dr. Henry Smith Williams,* in speaking of the treatment of this troublesome affection, says that if taken in the earlier stages, it can almost invariably be checked by applying repeated coatings of collodion. After ten days or two weeks of such treatment, the collodion should be allowed to peel off. He is very sanguine of this method of treatment, and says that it has never failed him (except in a series of cases in which it was found that the collodion had lost its contractile power), nor had he ever known it to recur in an ear so treated. He gives the four following rules, suggested by his experience:

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* Medical superintendent of the Randall's Island hospitals, *American Journal of Insanity*, July, 1894.

1. Use contractile collodion of the best quality.
2. Apply the collodion usually on the inner surface of the ear only. Exceptionally, it may be necessary to apply to the outer surface also, but this should be done cautiously, as there is some danger of producing sloughing from overpressure.
3. Apply at intervals of fifteen minutes till a coating of sufficient thickness to markedly contract the ear has been applied. Reapply as often as the coating tends to peel off—three or four times a day if necessary.
4. If the patient picks at the coating, restrain him with a camisole. This is only exceptionally necessary, but in rare instances it is absolutely essential. Those who adjure mechanical restraint must choose in these exceptional cases between the violation of their prejudices and a lifetime of deformity for the patient.

The collodion treatment is founded on the principle that constant pressure applied to the tumor will cause its absorption. Undoubtedly collodion is the ideal means of obtaining this pressure. This line of treatment only applies to the earlier stage of the affection. After the hematoma has become fully developed, or if rupture and discharge of the contents do occur, it is then but rational to treat the wound by ordinary modern aseptic methods.

Circular Insanity.

(*Alternating Insanity, Folie Circulaire of Falret.*)

This is a peculiar form of mental derangement occurring most frequently in females about the age of puberty, characterized by regularly alternating and recurring attacks of melancholia and mania, followed by a lucid interval during which the patient is free, or comparatively free, from the morbid manifestations of the disease. Each of these periods may vary in duration from a day to several years. The mania and melancholia may be of a mild type, or both may be very severe, or one may be slight and the other intense. As a rule, the shorter the duration of the lucid interval the more severe the attack of mania and melancholia, while the longer the duration of the lucid interval the milder are the attacks. In rare instances the stages of depression and excitement alternate continuously without intermission—the attack of melancholia no sooner ends than the maniacal attack begins. In some cases the mania is first, while in others melancholia; but whichever one begins the cycle, each succeeding attack resembles the preceding one, so that by carefully observing one cycle you can predict what the symptoms, course, and duration of the next will be.

The attacks of mania and melancholia, in the main, resemble ordinary mania and melancholia, which we have described. It is not possible to diagnose this form of insanity correctly, unless the case shows a history of a preceding cycle, or until it completes its cycle, and even then, in some instances, the case will have to be kept under close observation until several cycles have elapsed. It is, as a rule, an incurable disease, and generally requires asylum treatment.

Katatonia.

This is a form of alternating insanity in which the mental symptoms are accompanied either by convulsive symptoms or those resembling catalepsy, with trophic symptoms, cyanosis, and œdema of the limbs, weak pulse, etc.; or, in other words, it is a variety of mental disease in which the functions of the motor and trophic centers are specially involved. (Clouston.) According to Kahlbaum, this form of insanity may pass through five different stages—namely, melancholia, mania, stupor (melancholia with stupor), confusion (confusional insanity), and dementia—before completing its cycle. There are undoubtedly many cases that do not pursue this course, one or more of the stages being absent. Each stage is extremely variable in duration. The symptoms of the different stages correspond, in the main, to those of ordinary melancholia and mania, etc., respectively. The chief points of difference are that sometimes the commencement of the disorder is marked by convulsive attacks of a varying kind; that the limbs often remain for some time in any position in which they may be placed (cataleptic condition, met with chiefly in the stuporous form); that these patients, especially, are apt to assume the declamatory attitude with theatrical gestures, declaiming or reciting constantly, but incoherently; or there is a tendency to the frequent repetition in a weary monotone of words and phrases without sense or connection.

Prognosis.—The prognosis is, as a rule, favorable, but the disease may be of several years' duration; many cases recovering completely, others passing into dementia.

Treatment.—The treatment called for is, in the main, similar to that of melancholia and mania.

Paranoia.*

(*Monomania,* † *Delusional Insanity, Instinctive Insanity, Ideational and Intellectual Insanity of Maudsley and Hammond.*)

This is a form of insanity characterized by the development of a fixed delusion, or group of delusions, without emotional excitement or impairment of memory. In the majority of cases it is hereditary. It is a primary disease—that is, it is not the sequel of some preceding attack of insanity. In the majority of cases the individual, from childhood up, has been considered "peculiar," "odd," "eccentric," and was egotistical; a constant source of anxiety to his relations and friends. In other cases nothing unusual is observed until the delusions are developed. In many cases the patient is neither excited nor depressed; to all appearances he is like a sane individual, seldom betraying, by his looks or manner, any of his false beliefs. He differs from the sane individual in having a " fixed " delusion, which cannot be removed by any argument; any false idea may become fixed. There is not that clouding or impairment of the intellectual faculties that is met with in all other forms of insanity. The memory may be excellent, judgment on all ordinary matters sound, and the emotions well under control. Their reasoning faculties may be so perfect, their line of argument so logical, that they may be able to convince a common observer that their acts are perfectly justifiable. Many when conversing on different subjects will reason with judgment, and seem to have perfect intellectual soundness; but when their false ideas are discussed, will give full rein to their delirium. In many instances he is able to keep his delusion concealed for years, even from his most intimate friends; but, nevertheless, it influences the future mode and action of his life, both socially and from a business view. When once the delusion is developed, he clings to it with tenacity, and no amount of reasoning can convince him of its erroneous nature. He may develop the delusion of persecution, and this differs from that of melancholia in that there is also developed the delusion of grandeur, and that he is persecuted on account of his station in life, or because of his personal attributes, because he is some great personage, or the heir to some large fortune, or that he is the originator of some great invention, and an attempt is being made to defraud him out of the patent.

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* *Para,* in the Greek signifying beyond, and *noien,* to comprehend or understand, ergo, a condition of mind beyond comprehension.

† The term "monomania" is objected to on the ground that no one faculty alone can be deranged to the entire exclusion of all others. Granted that this be true, yet we cannot employ any other term that so completely covers all the different classes of delusions.

He may develop exalted delusions of his personal importance; he believes that he is a king, an emperor, a duke, etc., and, so far as possible, he plays the character he assumes. He may develop the delusion that he is the Son of God, or that he is some great saint; if a woman, that she is pregnant by God, that she is the Mother of Christ, etc. (so-called religious monomaniacs), and this class of monomaniacs are especially dangerous from the fact that they may commit homicide, suicide, or self-mutilation, believing that they were commanded by God. Some may develop the delusion that their food is poisoned, etc. It is a very striking fact that all pure cases of monomania of suspicion, sooner or later, die of phthisis. (Clouston.) Many of them will calmly and logically reason about their delusion (reasoning monomaniacs of some writers); the subject of a delusion being proof against all reasoning and probability, asserting his convictions with such confidence and tenacity as to impose even upon others.

Gray says that the delusions of the monomaniac differ from the delusions of melancholia and mania, in the fact that any agitation in the patient is produced as the *consequence* of these delusions, and the excitement does not *precede* the delusions. Some may have hallucinations of sight, hearing, taste, and smell. Others may develop an irresistible impulse or desire to do certain acts.

Delirium Grave.

(*Mania Grave, Typhomania.*)

This is a form of mental disturbance characterized by furious outbreaks of maniacal excitement and violence, with intermissions. Gray gives the following description of the affection: The patient is extremely incoherent, breaks, kicks, screams, talks incessantly, has hallucinations that are usually fixed and often very vivid, and there is generally such anæsthesia that injuries are not felt, so that one patient actually gnawed off an ungual phalanx of a finger. Great insomnia is present; the temperature ranges from 100° to 103°, sometimes even higher; the pulse is frequent and soft; and the patient rapidly emaciates.

To the excited period usually succeeds one of depression, almost of collapse, in which the patient lies quiet, staring, muttering, mute, as in the terminal period of acute exhaustive diseases. These conditions of excitement and depression may alternate, and in some cases the depression may not be so extreme, so that the patient may be aware of his condition.

The disease almost invariably terminates fatally, and when recovery does occur it is incomplete, leaving some permanent aberration of mind, or passing gradually on into general paresis or some form of dementia.

Pyromania.

This is a form of monomania, the chief characteristic of which is a morbid impulse or desire to set fire to houses or other things without any motive for the crime. It is most frequently met with in individuals about the age of puberty.

Kleptomania.

This is a form of monomania characterized by an irresistible desire to steal. It is by no means an uncommon occurrence for men, but especially women, of respectable families, who move about in the best of society, and who are able to satisfy their wants and tastes, to be arrested on a charge of stealing articles of different value. They will steal things which are often of no use, and are cast aside as soon as obtained. To distinguish between the real thief and a person mentally afflicted with the desire to steal, M. Paul Dotet, a distinguished French alienist, says: " It is possible for us to draw the line between the kleptomaniac and the shop-lifter if we know the value of the objects stolen. The professional thieves scorn all articles save those of some value, but the true kleptomaniacs pick up things of trifling cost in comparison."

The views of savant and detective are not far apart in regard to this matter. Thomas Byrnes, late chief of detectives of New York, said: " It is folly to say that there are no kleptomaniacs. An experience of more than thirty years with criminals and those who have been guilty of minor theft, but can hardly be called criminals, has proved to me that not only does kleptomania exist, but that it is a disease. Again, I have found it to be the result of a sudden impulse of a woman who could not repress an unrestrainable longing to possess a certain article which it seems to her at the moment life was not worth living without. Sometimes it happens that the mother steals for her child without the slightest thought that she is committing a crime. Such an event is, in my estimation, the result of disease or temporary insanity. We are prone to call all persons thieves who steal, regardless of the circumstances. I am free to say that I consider the displays made by the great stores of the country a constant temptation to persons whom either heredity or acquired mental affection has given a bent toward theft, which does not mean that they are thieves, but that they have been robbed, by some strange process, of all knowledge that they are committing a wrong."

Disordered menstruation and pregnancy seems to have some influence on the development of this morbid affection.

Kleptomania may be one of the earlier symptoms of general paralysis of the insane.

Dipsomania.

This is a form of periodical mania of which the chief characteristic is an irresistible desire for stimulants. This tendency for liquor may be suddenly developed in persons who previously had given no evidence of such a propensity. During the attack he has one purpose only—to procure drink. No meanness is too low, if it enables him to get his stimulant. He loses all moral restraint, jeopardizes his business interests, compromises his honor, etc. The attack may vary from a few days to several weeks. Frequently dipsomania may appear as a symptom in the course of various forms of insanity.

Nymphomania.

This is a form of mania characterized by an intense and irresistible desire for sexual intercourse, and for indulgence in lascivious conduct. To this irresistible impulse there may be superadded insane ideas, hallucinations, and disorders of general sensibility. The same morbid condition, when occurring in the male, has received the name of *satyriasis*. Occasionally these conditions occur during the course of various mental disorders.

Erotomania.

Clouston defines this as a form of insanity where there is an intensely morbid desire toward a person of the opposite sex, without sensual passion. Nymphomania, satyriasis, and erotomania have often been confounded and used as synonymous terms. This is incorrect, for, as is justly pointed out by Hammond, in the latter disorder there is no obvious excitation of the sexual appetite, but it is the emotion of love which is exalted, and not the sexual instinct; while in nymphomania and satyriasis it is the sexual appetite that governs, and which puts its impress upon the character of the sensorial derangements, the delusions, the language, the acts, and other phenomena.

Old Maids' Insanity.

A form of insanity so called by Dr. Clouston, and "ovarian insanity" by Dr. Skae. Clouston says that there is really no definite proof that the ovaries are either disturbed in function or disordered in structure in these cases, but that it consists, no doubt, of a morbid transformation of the normal affectiveness of woman toward the opposite sex. That the disease usually appears in unprepossessing old maids, often of a religious life, who have been severely virtuous in thought, word, and deed, and on whom Nature, just before the climacteric, takes revenge for too severe repression of all the manifestations of sex, by arousing a grotesque and baseless passion for some casual acquaintance of the other sex, whom the victim believes to be deadly in love with her, dying to marry her, or inflamed with sexual passion toward her, or who has actually ravished her after having given her chloroform, and uses the merest trifles as proof of her belief. Usually her clergyman is the subject of this false belief. Recovery is rare, the insanity often passing into some other form.

Insanity of Bright's Disease.

This is a variety of mental derangement, half delirium and half mania, which results from uræmic poisoning. It usually occurs in chronic cases of Bright's disease with contracted kidneys, where there has been enlargement of the heart and a tendency to dropsy for some time, and where the central nervous system has been long subject to the influence of imperfectly purified blood. (Clouston.)

During the attack the patient is restless; can hardly be restrained from getting up and leaving the house; may jump through the window if not restrained; he is in constant motion, moving around in the room, or, if in bed, the arms and the legs are continually on the go; may have to tie his hands to keep him from doing himself harm; he pulls at his hair or tongue or genitals. The frenzy may be so great as to require several attendants to restrain him. He has hallucinations of sight and hearing; also delusions as to persons around him. The attacks may vary from one to twenty-four hours. During the interval between the attacks he usually rests quietly, and regains consciousness completely, or nearly so, but is extremely prostrated. He is pale, anæmic, wasted away, tongue heavily and foully coated, appetite poor, bowels usually costive; there may be retention of urine, the urine having to be drawn with a catheter. The temperature may be above normal during the attack, but is usually subnormal during the interval. As the disease progresses, the patient grows weaker, passes into a stage of stupor, then coma, and death; or convulsions may end the history of the case. The disease may run its course within a few days, or, again, may continue six or eight weeks.

Epileptic Insanity.

This form of insanity may occur before, after, or take the place of an attack of epilepsy. The insanity of epilepsy includes all forms, from melancholia and acute mania to dementia. During these attacks loss of memory may be complete, or there may be a faint, dream-like recollection of things that occurred during the attack.

In the form of insanity which precedes the epileptic fit, the patient may become, without apparent cause, sad, depressed, and despondent; assuming more the melancholic type, he imagines that he is persecuted or ill-treated; that friends and others have injured him; he is in a dream-like state, doing things automatically, or he may become peevish, irritable, and quarrelsome, and may commit acts of violence. When the epileptic fit comes on, these symptoms usually all disappear, and the individual regains his normal condition of health again.

Mania may be developed in any of the different forms of epileptic insanity, but it is most frequently met with in that following an epileptic fit. Immediately following a fit, an outburst of uncontrollable fury of the most violent and destructive kind may take place; or again, after the fit, the patient may pass into a more or less prolonged period of sleep, and, upon awaking, the onset of mania may suddenly manifest itself. He may be either homicidal or suicidal, and he is utterly regardless of all personal danger. He develops ideas of persecution and ill-treatment; believes himself to be surrounded by demons or enemies, and, in order to escape from these supposed enemies, may strike right and left, inflicting injury or death on whomsoever happens to be near him. In some instances the acts of these maniacs are most vital and brutal, repeatedly striking their victims and fearfully mangling them. These cases are, without exception, the most dangerous of all lunatics. After the fit of violence has passed, he may regain consciousness suddenly, and not be aware of anything that occurred, or he may dimly comprehend the magnitude of his crime (providing he committed one) and try to escape and hide himself. The attack of mania may last only a few minutes, rarely more than an hour. This form of mania, unlike ordinary mania, does not leave any impairment of the intellect behind; a patient who has been violent and uncontrollable one day may be perfectly rational upon the next—a subsidence of all the phenomena and complete return to his ordinary state of health.

In some cases the epileptic fit is followed by melancholy with similar ideas of persecution as in mania. They are most apt to take unfounded dislikes, especially to their relations and those near them, and may take revenge upon them for imaginary slights and ill-treatment; or, again, they may brood in silence over their unhappy condition.

In the so called larvated insanity, or, as it is sometimes termed, *masked epilepsy*, the attack of insanity takes the place of the regular epileptic paroxysm. In this form of insanity there may be loss of recollection of whole continuous periods of life. While in this condition the patient may wander from home and be gone for days at a time, or may go on long journeys, and when found is unable to give any account of where he has been or how he got there. While in this state he may have committed homicide, theft, or arson, and when the attack passes off, and consciousness returns he is unaware of the deed—memory being a perfect blank. In other cases unconsciousness, with a tendency to run, to strike, or to perform some simple mechanical act, occurs. Many cases that are diagnosed as transitory mania are undoubtedly due to some unsuspected forms of epilepsy; by tracing back the history of the individual, we are usually able to discover indications of epileptic disease in its hidden varieties, such as nocturnal fits, or in some instances simply vertiginous attacks. A person, while suffering from an attack of epileptic insanity, may commit a crime, having apparently used considerable cunning in performing the act, and afterward carefully concealing it, yet, when the attack is over, there is complete ignorance of all that has happened. More murders are committed by individuals while suffering from epileptic insanity than from any other form, possibly alcoholic insanity excepted. Patients suffering from epileptic insanity may have not only delusions, but also vivid hallucinations of sight, hearing, taste, and smell.

The epileptic psychosis may exist in every degree, from the merest excess of irritable temper, up to the most dangerous homicidal impulses and acts. Clouston says that it is an axiom of asylums " never to contradict or attempt to reason with an epileptic when excited." In ordinary epileptic seizures each attack resembles the preceding one; the same is true of the epileptic attacks of insanity, each attack coming on and exactly resembling the previous one. In some instances the attack of insanity terminates so quickly and recurs at such distant intervals that one might think it a complete recovery after a simple attack of mania, unless we take into consideration the history of epilepsy. The attacks of epileptic insanity may vary in duration from a few minutes to hours, days, weeks, and in some instances even years. As the disease progresses the mental failure increases; the bodily health, however, usually improves or is fairly good, and the patient passes eventually into a state of weak-mindedness, or, as it is commonly termed, epileptic dementia.

Treatment.—Compare "Treatment of Epilepsy" and "Treatment of Insanity in General."

Hebephrenia.

(*The Insanities of Puberty and Adolescence.*)

This is a term applied to those forms of mental disturbance occurring at puberty or immediately after. Puberty is the first really dangerous period in the life of both sexes, as regards the occurrence of insanity. The next period is that of adolescence. In speaking of the forms of insanity occurring in young persons, these two terms are usually referred to as synonymous periods. Referring to this Dr. Clouston says: "I cannot hope to change the accepted meaning of the present nomenclature, but I would, if I could, distinguish between puberty and adolescence in this way: I should restrict puberty, as is now done when the term is used in a scientific and physiological sense, to the initial development of the function of reproduction, and to its first appearance as an energy of the organism; while I should use adolescence to denote the whole period of twelve years from the first evolution up to the full period of the reproductive energy, when the bones are finally consolidated, and the full growth of beard and the sexual hair takes place, and there occurs the perfect assumption of the manly form in the male sex, and the full development of the adipose tissue and the mammæ gives the female form its perfect grace and contour."

The period of puberty usually occurs, in the female, at about the age of fourteen, and is recognized by the development of the body and the appearance of the menstrual flow. In tropical countries, however, sexual development takes place several years earlier—sometimes as early as the eighth year; also it takes place about a year earlier in girls who live in the city than girls living in the country. In males puberty is a little later, occurring about fifteen or sixteen, and is recognized by the appearance of hair on the face and on the mons veneris, and in the deepening of the voice—" a change of voice."

The period of adolescence ranges from twenty to twenty-five—the female sex attaining its full bodily development first, while in the male sex the body does not reach its full development till about the age of twenty-five.

While an individual is changing from childhood to girlhood or boyhood, from girlhood or boyhood to womanhood or manhood, is the great period in which hereditary tendencies manifest themselves. This is the age at which a man suffers, not only from the sins of his father, but also those of his forefathers, " even unto the fourth and fifth generations." Heredity has an important bearing in the production of this form of insanity, it being one of the most hereditary of all forms of mental disease. In the greater majority of cases, an hereditary history can be elicited; not necessarily that some past relative suffered from this form of insanity, but that they were subject to some of the neuroses, such as neuralgia, neurasthenia, hysteria, migraine, etc. Masturbation, especially in connection with mental overwork, may act as a cause. Quite frequently, however, masturbation may be considered as a symptom, rather than a cause.

This form of insanity is met with more frequently among girls than among boys. The forms of mental derangement that occur at puberty and adolescence are in the main identical, so that the same description applies to both periods. The insanity may simulate, to a certain degree, melancholia, mania, or any of the various types of insanity which have been described. Yet the depression of spirits is not as profound as in true melancholia, nor the continuous flow of ideas and hallucinations and hilarious delusions so marked as in true mania; all the symptoms, in fact, appear shallow and unreal as compared with the states of melancholia and mania.

The milder forms are characterized chiefly by perversions of the normal spirits; he becomes changed in disposition; he is vicious and troublesome; commits various petty crimes—may steal money from his relatives and run away from home (these are the youths who, after reading yellow-backed dime novels, start out to be heroes). They will lie, cheat, and resort to all kinds of deceit to accomplish their purpose; they are disobedient, morbidly self-willed, setting at defiance the authority of their parents.

As the disease progresses he may become violent, destructive, shouts, smashes furniture, and is quite unmanageable; the habits become filthy and degraded; masturbation is practiced openly and repeated frequently. This may continue from a few days to weeks, or even months, and, as the attack passes off, he passes into a stage of stupor simulating secondary dementia. This may be followed by a period in which the mental condition clears up, to again be followed by another attack of mania. This may be repeated from two to fifteen or twenty times. The maniacal condition, after many periodic remissions, may gradually pass into secondary dementia.

In other cases the initial symptoms may simulate those of a mild form of melancholia. He is low-spirited, depressed, and despondent; the future appears dark and forbidding; he becomes suspicious, develops a dislike for his parents, brothers, or sisters; wanders aimlessly about; may develop the suicidal feeling, but it is not as persistent and of as intense character as that of typical suicidal melancholia. His delusions are not of the nature of what are termed "fixed" delusions, but partake more of the nature of an incoherent delirium. This stage of depression is followed by mental enfeeblement, marked by a silly disposition; may affect religious sentiments in one breath.

profanity in the next, and in the following suddenly burst out in causeless and silly laughter. The melancholic attacks are usually of longer duration than the maniacal, and the remissions are not so well marked.

In other cases they are actuated by silly semi-delusions or mawkish sentimentality; he imagines that every woman who casually notices or who speaks to him is violently in love with him; he addresses ladies on the street, writes love-letters to all his lady acquaintances, and, as the saying is, makes a fool of himself in general. In other cases, however, there is just the opposite of this condition—a dislike and an avoidance of the opposite sex; he is overbearing, insolent, and fault-finding; tries to assume the manner of a grown-up person.

Diagnosis.—The diagnosis of these forms of insanity is not usually a difficult matter. The facial expression alone is often sufficient to give a clew to the form of mental trouble from which the individual is suffering. The facial expression is characterized by a weak, blank, silly, expressionless appearance; the eyes are lusterless and dull; then, too, there is lack of depth to all the mental symptoms, the patient bursting out in frequent paroxysms of silly laughter.

Prognosis.—The prognosis, as a rule, is favorable, many cases making a complete recovery; others only partial recovery, ending in monomania or delusional insanity; others terminate in chronic mania, and a few in secondary dementia. Even in those cases that recover, the course is long and protracted before all the mental faculties clear up entirely.

Treatment.—As this form of insanity is more especially the result of disturbed cell-action, and, as cell-action in the brain and everywhere in the body is controlled by the sympathetic nervous system, the first object of treatment would be to restore the inharmonious working of the sympathetic, thereby correcting the disturbed cell-action. This is best accomplished by orificial measures. Orificial measures not only remove all sources of peripheral irritation, but also stimulate the sympathetic nervous system, thereby improving the capillary circulation and instituting universal changes; thus awakening into action all the latent energies of the entire system.

For the therapeutical treatment, compare "Treatment of Insanity in General."

Climacteric Insanity.

This is a form of mental disturbance which precedes, occurs during, or follows the climacteric period, and may affect either sex. A climacteric period occurs in men as well as in women, but occurs at a later time of life, and is much more irregular and indefinite. There is nothing in the male to mark it off so clearly as the menopause in the female. The real climacteric period in both sexes is never a definite, fixed time, but may extend over several years; in women from the fortieth to the fifty-fifth year; in men from the fifty-fifth to the sixtieth year. The term climacteric does not refer, as is so often supposed, to the mere cessation of the functions of menstruation in women, but has reference to the normal physiological changes, both mental and physical, which occur about that period in women, and a little later in men. In the male the decline of functional manhood is gradual, and frequently continues even to old age. In the female, however, it is different; her functional womanhood usually ceases at the climacteric, and consequently the phenomena (headache, alternate flushings of heat and cold, sinking spells, etc.) attending the normal physiological changes are more marked than in the male. Although the changes that are dependent upon the diminution and final disappearance of the generative activity in women are not so well marked in men, yet there are developed certain physiological phenomena which have an important bearing on his life. Few conditions exercise so profound and widespread an influence upon the physical organism and mental health as does the climacteric. At the climacteric there comes an interruption in the normal physiological processes of the system that reacts so powerfully on the mind, and, in unstable brains, may result in the unbalancing of the mind. At the climacteric period it not infrequently happens that any nervous affection from which they have suffered at puberty returns.

The prodromal symptoms preceding climacteric insanity may be marked by fearful headaches, " feeling as if she would go out of her mind," heat and oppression on the crown of the head, feelings of alternate heat and cold all over the body, faintness, dizziness, sinking sensations, palpitation of the heart; also she may be subject to various forms of neuralgia. She becomes restless, sleepless, anxious about trifles, sad, and depressed; she neglects her household duties, and is conscious of a loss of affection for her husband and children; may be a repugnance for her husband. As the disease progresses, and on the appearance of the mental symptoms, all the sensorial symptoms (headaches, etc.) subside; the sadness deepens into profound melancholia. She is gloomy, despondent, fearful, and apprehensive; has an undefinable dread that something is going to happen; may develop distressed and vague suspicions of those around her; that her family and everyone is against her; that they are trying to poison her; she suspects her husband of infidelity—searches his pockets, opens his letters, watches the bedrooms of the servants, talking about it openly, and thus starting scandal; may commit acts of violence, or destroy property, with the idea of spiting her husband; may take to vicious habits, as drinking or masturbating, or may become a kleptomaniac. Often these cases develop a delusion that they have in some way become changed bodily; that their head or limbs are made of wood, glass, etc.

One great characteristic of the majority of these cases is the idea of their *spiritual unworthiness;* they consider that they have committed some great sin and are eternally lost. Savage says that this is the age of " the unpardonable sin," and that the most common idea and the scriptural one is that the unpardonable sin " *is blasphemy against the Holy Ghost.*" " *All manner of sin and blasphemy* shall be forgiven unto men; but the blasphemy *against the Holy Ghost shall not be forgiven unto men.*" (St. Matthew, xii. 31.) But here arises the difficulty as to what the blasphemy against the Holy Ghost is. The consensus of opinion among theological students is that it is the *resisting* the Holy Ghost; but the insane individual may settle upon some word or act, and even an unholy thought, as the great unpardonable sin which damns her soul eternally.

A few cases are maniacal in form, the prodromal symptoms of these cases being similar to those preceding an attack of melancholia. After the onset of the disease, however, the symptoms present a widely marked difference from those of the latter affection. She is extremely anxious, sleepless, walking about at night; there may be ceaseless laughing, dancing, swearing, holding conversation with imaginary people; speech becomes almost incoherent; may become extremely violent, breaking everything that she can lay her hands on; noisy; sometimes abusive, and often dirty in her habits. May develop delusions that she is being persecuted by enemies, etc. There is great restlessness; there may be purposeless and rhythmical movements of the limbs or head. In these cases there is usually rapid and great loss of bodily weight.

Prognosis.—The prognosis is more favorable in women than in men, and in persons whose previous health has been strong and sound. The prognosis is more favorable for a rapid recovery in mania than in melancholia, but as regards life the latter is more favorable. Cases of mania may recover within six weeks but more frequently it requires from three to six months. and in some instances even longer, to effect a cure. Melancholia may require three, six, or nine months. Many cases of climacteric insanity require several years to make a recovery. During the climacteric change many faculties hitherto active become lessened in their activity and are abolished, and when the brain adjusts itself to these changed conditions, then there is a possibility of the mental faculties clearing up again. Clouston says that he never gives up hope of a recovery in a climacteric case for four or five years, except where there are symptoms of dementia or " fixed " delusions.

In all these cases of climacteric insanity we should with all our energy try to strengthen the constitution and improve the nutrition by the judicious use of nutritious food, exercise in the open air, the use of baths, etc., and with the indicated remedy treat the mental disease as you would any diseased condition. In selecting the indicated remedy we should, of course, always choose the one corresponding to those remedies that have a curative relation to the generative functions.

Aurum met.—Melancholy; feels hateful and quarrelsome; weeps, prays, thinks she is not fit for this world, longs for death, strong inclination to commit suicide.

Actea racemosa (*Cimicifuga*).—This remedy should be kept in mind in suicidal melancholia; also in patients who are desirous of being alone, and dislike to talk; who like to sit by themselves and weep, and declare that they will go crazy.

Ambergris.—Ambergris is a remedy to be thought of in bad effects following business disaster and excessive mental excitation, followed by melancholia, great sadness, and fear of going crazy.

Alumina.—Seeing blood on a knife, she has a horrid idea of killing herself, though she abhors the idea.

Arsenicum.—Excessive anguish, with irresistible desire to commit suicide; great mental anxiety, and restlessness; sleepless or disturbed sleep; worse after midnight, with disinclination to remain in bed.

Chamomilla.—She is constantly moaning and muttering to herself; walks all the time, looking down; is disinclined to talk, and angry if anyone speaks to her; tries to get away from her friends, if they seek to comfort her; sleepless at night, and uneasy during the day.

Cactus.—The cactus patient is sad and hypochondriacal, and has frequent palpitation of the heart; difficulty in finding the right expression when speaking; indescribable fear that something is going to happen.

Calcarea.—Despondent; great anxiety and apprehensive of some misfortune or impending evil; face pale, eyes deep-seated and surrounded with dark rings; oppression of chest, with shortness of breath and palpitation on going up the slightest ascent; feet and hands cold; night sweats.

Digitalis.—Digitalis is most used when the patient is in a dull, lethargic condition; the pupils are dilated to their widest, yet all sensibility to light or touch seems lost; the pulse is full, regular, and but slightly intermittent, and very slow. The slow pulse is the grand characteristic for the selection of this remedy.

Glonoine.—Confusion of ideas; cannot tell where he is; forgets on which side of the street he lives; well-known streets seem strange; recognizes no one; repulses her husband and children.

Ignatia.—Desires to be alone; changeable disposition, laughing and crying almost in the same breath; does not like to talk; imagines that her soul connot be saved; at times rages and tears her clothes, can scarcely be restrained; great sleeplessness, despair, severe palpitation; always cold; no desire to eat or drink; constipation.

Nux vom.—Very easily bewildered; everything goes wrong; inclined to get angry, or excited easily; of a spiteful, malicious disposition; ill-humored; resists obstinately the wishes of others; no appetite; tongue heavily coated, white or brownish, especially at the base; bowels costive, with ineffectual and frequent urging to stool.

Platinum.—Spends her time in deep meditation, or praying; says that she has brought disgrace upon her family, and that she has incurred the penalty of damnation.

Sepia.—Sepia is called for in those nervous, oversensitive individuals subject to nervous irritability, with sadness, despondency, and constant worrying about the future; great indifference or aversion to her family.

Silica.—The patient is indifferent, apathetic, low-spirited, wishes to drown herself.

For the general management of these cases, see "Treatment of Insanity in General."

Senile Insanity.

This is a form of insanity that occurs in old persons during the period in which they are passing from old age to " second childhood." This period, like that of puberty and adolescence, is associated with similar instability and tendency to emotional disturbance (the former might be called the evolutional and the latter the involutional insanities). It is impossible to fix the age at which senile insanity begins, for some men are older at fifty than others are at seventy. Senile insanity differs from senile dementia in that in the latter the mental decline is gradual and progressive, and the inevitable end is death; while in the former, when the brain functions have become readjusted after passing into the stage of " second childhood," the mental faculties may clear up.

Senile insanity is not to be confounded with climacteric insanity, for the latter is due to *physiological* changes occurring about that time, while the former is distinctly due to *senile* changes in the organism.

The forms of mental derangement are, on the whole, like those of earlier life, and may assume the melancholic, maniacal, or the delusional type.

The symptoms are, in the main, similar to those of the respective forms of insanity occurring in earlier life. " The chief difference being that there is usually less intensity in the onset of the disorder; that there is less force in the delusions, which are of a more limited number; that the sexual illusions are more marked." (Ludwig-Wille.) Another marked characteristic of senile insanity is that it is more apt to become aggravated at night than any other form of insanity.

The course of senile insanity is similar to that of other insanities occurring earlier in life. Many cases recover and spend the rest of their life in perfect mental health; others may recover partially, being in a mild state of mental weakness; still others may pass into hopeless dementia.

Treatment of Insanity in General.

It does not fall within the province of these lectures to treat in detail those cases of chronic or incurable cases of insanity which require asylum treatment, but simply to give such points and suggestions as will aid you in such cases as you are liable to meet with in your daily work.

After you have examined the case and made your diagnosis and prognosis, if it has been decided to have the patient treated at home, what shall be the line of conduct? The first thing is to select a suitable room or rooms. The room should always be airy and well ventilated (avoid all dark and gloomy apartments), simply furnished, and as free from the household noise and noises of the street as possible. Preference should be given to a room on the second floor, unless the patient has suicidal tendencies, and in that case the ground floor should, by all means, be selected. The next thing of importance is, undoubtedly, to get a good nurse—a responsible, skilled, patient, experienced person. If two nurses are required, keep the better one for night work, for the night management is the most important and the most troublesome. Some patients have the provoking habit of sleeping during the day and waking at night. It is not advisable to attempt to break up this habit for it might prove harmful; they had better sleep by day than not to sleep at all. After the procuring of good nurses, comes the subject of diet, exercise, baths, etc.

In the greater majority of cases that come under your care you will find that for a considerable time they have not partaken of sufficient food; consequently they are emaciated, the system is poorly nourished, and their general vitality lowered. One great factor in the treatment of these cases is to *feed*. Food, an abundance of food, must always be administered, no matter what the state of the patient's digestion may appear to be, no matter how directly contrary it may be to his inclination. One writer has said: " Fatten your patient and you will improve his mind." Night-feeding as well as day-feeding is often needed. Often a full meal just at bedtime will be a better sedative than any hypnotic drug. It is not enough to depend upon milk, broths, beef extracts, etc., but solid food, lots of it and of the most nutritive kind, must be given. Some cases will eat only when the food is placed in the mouth; some will eat only when the nurse or attendant tastes it first. Some cases will not eat when anyone else is present, and must be left alone in a room with their food. Other cases, however, from the delusion that their food is poisoned, that they are commanded by "voices" not to eat, or that their bowels are stopped up, and that it will do them no good to eat, as it cannot pass through, obstinately refuse food. Undoubtedly many cases have resulted fatally on account of this starvation process; that is, the absence of food, or, at most, the partaking of it only in small quantities, so deranges the general nutrition of the body and lowers the general vitality that it permits organic visceral diseases to develop, which rapidly prove fatal; thus if this one point (the giving of sufficient food) had been strictly adhered to, these patients would have eventually recovered. Then comes the question, How long may a patient be left without food? Speaking generally, it may be said that if a patient refuses three meals consecutively, she should be fed.

When persuasion, threats, and all moral means have failed, then you must resort to *forced feeding*. This may be accomplished by one of two methods—namely, by means of the nasal tube, or the stomach-tube. The ordinary French red rubber elastic tube, with a funnel of any sort inserted into one end, will answer for a nasal tube; then, by oiling the other end and passing it along the floor of the nares to the pharynx (about six inches of tubing being used), and by pouring liquid into the funnel, the patient *must* swallow. In the great majority of cases, however, it is better to use the stomach-tube. This may consist of the ordinary stomach-pump, or a French rubber tube measuring about twenty-eight inches in length and seven-sixteenths of an inch in diameter, with a bore of five-sixteenths of an inch, with a funnel attachment.

The only advantage that the stomach-pump has over the stomach-tube is, that more solid food can be forced through it than will flow through the funnel by mere force of gravity. When using the stomach-pump, or tube, the mouth will have to be forcibly opened and held there by a suitable instrument, usually a mouth-gag that works with a screw. In some cases it will require two of these instruments, one put in at each side of the mouth at once, and both screwed up at once. A point to be remembered in using these mouth-openers is to cover the steel points with cloth or tape, so as to prevent chipping of the teeth. About eighteen inches of tubing should be passed, and it should not be done too quickly. About four inches should be drawn up so as to prevent the end adhering to the wall of the stomach. It is a good plan to have a white line painted around the tube about sixteen inches from the end, to show when enough tubing has been passed. It is better to simply moisten the tube with warm water, instead of oiling it.

The patient is placed on a bed or sofa, with the head raised, then open the mouth, insert the tube, and pour the liquified food into the funnel. In regard to the food, any kind of food that can be liquefied may be used. Clouston says he has found, from long experience, that a liquid custard of new milk, cream, and three or four eggs, flavored with a dash of nutmeg or sherry, is the very best and handiest form of liquid diet at first, and for a time at least, but, if the feeding has to be long continued, the best way is to have a big mortar, and pound into a liquid form, with beef tea, the ordinary diet. Beef, mutton, fowl, fish, and vegetables of all kinds can be liquefied in this way. Always add a quarter of a pound of sugar to each meal, and feed twice or thrice a day. Before commencing to feed, the operator should ascertain that the food is not too hot or too cold, and also if it is of the proper consistency. The patient should be kept lying down when the feeding is over, as the operation generally causes no little shock to the nervous and circulatory systems.

In some cases one feeding by the mouth or nose will be sufficient to cause them to take the food when offered them; in others it will have to be resorted to for days, weeks, and even months. But, as a general rule, a few feedings by means of the tube is a greater moral persuader than all the coaxing and threatening you can do; for, however obstinately they may at first refuse to take their food, as soon as they see you getting out the tubes to force them, they hastily begin their eating, rather than have you proceed.

In order that the food just given may be digested and assimilated, the next point of importance is to see that plenty of exercise in the open air is taken. This should consist of driving or walking, supplemented with some kind of employment while at home. The patient should be induced to perform some kind of regular work, for by inducing him to engage in some kind of physical employment his mind is distracted from his mental condition; also it is a matter of extreme importance that the patient should not be left alone for any considerable length of time unless occupied with physical labor.

In very severe cases, in which emaciation is great, weakness extreme, and disinclination to exertion profound, the employment of massage may be of great benefit to start the process of nutrition.

Baths of various forms have considerable value in the treatment of these cases. They promote the action of the skin, and keep it in a healthy condition, thus relieving the internal organs of their superabundant load. The kinds of baths most frequently called for in these cases are *the prolonged warm sitz baths, hot air or Turkish baths,* and the bath termed *the suffusion, or tepid and cold water from a pail*—that is, the patient sits in an empty bath tub, and first a pail of tepid water, of between 80° and 90°, is poured over the head and shoulders, followed immediately by a pail of cold water.

It is also recommended to place the patient in a warm bath, and leave him there for six, eight, or ten hours, and, if thought best, apply cold effusions to the head at the same time. Warm baths are of especial value in acute mania.

In electricity we have an agent capable of influencing beneficially many forms of insanity. It is of especial use in the earlier stages (those cases in that stage termed borderland) and in the milder forms of insanity. Cases sufficiently grave to be committed to the asylum are generally too far advanced or too serious to be affected by the employment of electricity.

Arndt says that when well-marked irritation is present, the descending current (galvanic) should be employed—that is, the anode on the head, the cathode peripherally; but if a state of depression or torpor exists, the ascending current should be used—the cathode on the head, the anode peripherally. In other words, if a sedative effect is desired, use the positive pole on the head; but if an exciting action is desired, use the negative pole on the head.

Prince recommends the use of an electrode which covers the head in the form of a cap, the other electrode being applied to some other part of the body.

In those cases in which the usual treatment consists in rest, strengthening diet, and tonics, general galvanization or general faradization will prove of great benefit.

Static electricity will usually prove of more benefit than any other form of electricity in the treatment of insanity. Many unpleasant symptoms of psychical origin, such as pain, paræsthesia, etc., can often be entirely dissipated. Mental depression and insomnia often yield after a few applications. Used in the form of insulation, it acts as a powerful sedative. Prince says that for mental depression and other psychical symptoms he would recommend allowing treatment with head douches for relatively prolonged sittings—say twenty minutes to half an hour.

In primary dementia, general paresis, and melancholy with stupor, general faradization is indicated; the faradic brush may be applied to the whole body, or, instead of the brush, wet sponges may be applied.

No other single measure equals in any degree all-round orificial work in the treatment of insanity. In fact, no case should be pronounced incurable until after orificial treatment has been thoroughly tried.

Orificial treatment will not only cure many cases, but make others that previously failed to respond to treatment susceptible to the influence of means that otherwise were inadequate to materially benefit them.

Suggestive therapeutics, or the power of hypnotic suggestion, has become a recognized principle in therapeutics. Many cases of insanity, where the brain has not become diseased, may be benefited by hypnotic suggestion.

Therapeutical treatment, though coming last, is not the least. Many of these different varieties of insanity require similar remedies. It is not the name of a disease for which we prescribe, but the array and totality of the symptoms in a given case that indicates the choice of a drug. Each case should be carefully individualized in selecting the proper remedy, and, having found it, administer it in the smallest quantity capable of curing the case.

Aconite.—Great fear of approaching death; of darkness and being alone; afraid of a crowd, or crossing a busy street; great mental anxiety; restlessness; agonizing tossing about; oversensitiveness, mentally and bodily; mood peevish, irritable, malicious; variable humor, at one time gay, at another time sad; head hot, face red and swollen, or alternately red and pale; constant, excessive thirst and loss of appetite; anxious lamentations; does everything in great haste, must move about or change position often; sadness with solicitude; concerned about the future; about her recovery, or fears loss of reason. Aconite is especially useful in acute cases where the disease has been caused by fright, anger, etc.

Actea rac.—Complete insomnia; imagines he sees rats, mice, lizards, and other strange objects; talks incessantly, changing from one subject to another without good reason; pulse full and quick; eyes wild and staring; stomach disordered; tremor, scarcely visible, but apparent to the touch; patient cross and taciturn.

Agaricus.—Disinclined to answer questions; cannot find the proper word, uses the wrong word; talks incoherently; passes rapidly from one subject to another; now gay, now melancholic; frenzy, causing him to assail and injure himself; strength augmented; great loquacity; sings, talks, but does not answer questions; considers himself immensely wealthy and happy; mischievous melancholy, trying to do injury or damage from inward restlessness and anxiety; desire for alcoholic drinks; pupils contracted; dry, tremulous tongue; trembling of the hand; twitching of the gluteal muscles.

Alumina.—Consciousness of his personal identity confused; apprehensive of losing his reason; makes mistakes in speaking, using words not intended; evil ideas force themselves on him against his will; low spirited; trifling things appear insurmountable. Symptoms all worse in the morning on awakening.

Ambra grisea.—Excessive mental excitement, followed by melancholy, great sadness, and fear of going crazy; sits for days weeping; distorted images, grimaces, and diabolical faces crowd upon his fancy; all the symptoms aggravated by the presence of other people. Ambergris is a remedy to be thought of in bad effects following business disaster.

Anacardium orient.—Everything appears as in a dream; weak memory; remembers with difficulty; retains nothing in his memory; he is deficient in ideas, and soon loses his subject without being aware of it; has fixed ideas; that the mind and body are separated; that he is possessed of the devil; that strange forms are following him; seems to have two opposite wills; is inclined to laugh when he ought to be serious, and does not incline to laugh when tempted by ludicrous things; imagines he hears voices of people who are far away; an irresistible desire to curse and swear; furious, has to be kept in a strait jacket; irritable, passionate, and contradictory; a slight offense makes him excessively angry, breaking out in personal violence; malicious, wicked, and cruel; the patient is dull and stupid; gaze fixed; pupils, first contracted, later dilated; strange expression of the face. This remedy is chiefly useful in acute dementia, and in the later stages of various forms of mental derangements after the acute stage has passed.

Arnica.—The patient sits in a semi-stupid state; appears to be absorbed in deep thought, yet thinks of nothing; forgets the word while speaking; declines to answer questions; head feels hot to him, body feels chilly; tired feeling, as after hard work, or as if beaten; loss of appetite; thirst without any external heat; dryness of the lips and tongue; brown streak through the center of the tongue; trembling of the lower lip; involuntary discharge of urine and fæces.

Arsenicum.—Great mental anxiety and restlessness; excessive anguish, with an irresistible desire to commit suicide; very despondent; does not wish to recover, as she thinks she is in the way, and her family would be better off without her; predicts the day he will die; fixed idea that he and his family will die of starvation; tormenting hallucinations; he imagines he sees all kinds of vermin in his bed; sees demons, rats, and mice; hears voices; disposed to quarrel; the least thing offends him, and moves him to anger; vexed and dissatisfied with everything; sleep restless, disturbed by frightful dreams; patient emaciated, haggard, anxious in appearance; deathly color of the face; dropping of the lower jaw; lips dry and cracked; tongue red and dry; has an intense desire for small quantities of water at short intervals; loss of appetite; burning pains in the stomach and bowels, with inclination to vomit; œdematous swelling of the feet; cold, clammy sweat; cadaverous odor. Arsenicum is especially called for in those cases of insanity where there is general debility and a run-down, exhausted state of the system.

Aurum.—He howls and screams, and imagines he is irretrievably lost; religious mania; prays all the time; weeping and praying; mind constantly turns to suicide; imagines that he is unfit for this world; that he can never succeed; disposed to shun people; if meeting someone it gives him a nervous trembling, and he has to weep; continued sleeplessness; although weary, no inclination for either rest or sleep; aversion to food, especially meat; putrid taste in the mouth; tongue dry and coated; trembling of the tongue; bowels usually obstinately constipated; stools very large in size or very hard or knotty.

Baryta carb.—Weak memory; forgets what was just said, just done, or what he was going to do or get; in the middle of speech the most familiar words fail; great mental and bodily weakness; childishness; senile paralysis, with loss of memory, and trembling of the limbs. Baryta is especially useful when, with the above symptoms, there is paralysis of the tongue.

Belladonna.—The patient flies into a violent rage, with little or no provocation; disposed to quarrel without cause; suddenly screams out, claps his hand to his head; attempts to bite, to strike, or to spit at the attendants; tears everything within reach; overturns and destroys the furniture; tears his clothes into shreds; he is very restless, especially at night, keeping everyone in the house awake by his noise and craziness; his manners are foolish; talking and laughing, howling, jumping, and singing senseless songs; making lascivious advances; or there may be depression, with moaning, groaning, and fear of immediate death; weeping on the slightest provocation. Patient sleepless, or sleep disturbed by anxious, frightful dreams; drowsiness with inability to fall asleep. Of the actions of belladonna, Dr. William M. Butler (as quoted by Worcester) says: "In two forms of insanity belladonna has proven itself pre-eminently curative. Acute mania, attended with great excitement, violence, and destructiveness, and accompanied by the characteristic cerebral congestion, and in melancholia, where the mind is extremely dull, stupid, and slow to act, with great heat of head, dilated pupils, congestion of the eyes, full pulse, and persistent sleeplessness. In the former class of cases we have found the 30th the potency most effectual, while in the latter, frequently repeated doses of the 1st potency of even the tincture, have been necessary even to achieve the desired result."

Bryonia.—Exceedingly irritable and inclined to be angry; easily offended; wishes to be left alone, has no desire to move, although he feels better out doors; great forgetfulness; confusion in the head, with drawing in the occiput, extending to the neck and shoulders; apprehensive; uneasiness and dread on account of the future in regard to his domestic or business affairs; even at night he dreams of business; face red, hot, and puffy; lips dry, brown, and cracked; tongue thickly coated white or yellowish; excessive thirst; drinks large quantities at a time; offensive stool; dark, almost brown, urine; full, hard, and rapid pulse; restless sleep, with moaning; great weakness and exhaustion.

Bufo.—A sort of imbecility in which the person loses all decency. He becomes a confirmed masturbator, and seeks privacy to indulge in his vicious habit.

Calcarea carb.—Apprehensive mood; as if some misfortune were about to happen; fears she will lose her reason, or that people will observe her confusion of mind; despairing, hopeless of ever getting well; with fear of death; tormenting those around her day and night; talking of murder, fire, rats; sleeplessness from some idea arousing him from slumber; face pale or sallow; face waxy pale; eyes deep set, surrounded by deep rings; ravenous hunger, or else loss of appetite; taste sour, or salty, or like ink; metallic or leaden taste; white coated tongue; abdomen hard and distended; swelling of the lymphatic glands; a tendency to obesity; hands and feet cold; night sweats; profuse sweat during the day from the slightest exertion.

Cuprum.—Mania characterized by a wild look of fear; tries to escape; mania, with biting and tearing things to pieces; insane, foolish gestures of imitation and mimicry; full of insane, spiteful tricks, illusions of imagination; does not recognize his own family; unhappy, apprehensive, anxiety and despair;

attacks of unconquerable anxiety; sleep full of dreams, restless, and unrefreshing; pulse feeble, somewhat infrequent, unequal; skin moist, feet generally cold; patient has a pale, miserable look; afraid of everyone who approaches him; shrinks away from them; restless, tossing about.

Digitalis.—Morose, irritable and gloomy; insane obstinacy and disobedience, with desire to escape; great anxiety; depression and dread of the future, with sadness and weeping; profound melancholy, worse by music, with frequent sighing and weeping, which brings relief; patient dull and lethargic; pupils dilated, and all sensibility to light and touch seems lost; the pulse is at times rapid, at other times slow and feeble. and is very much accelerated by motion, especially by rising from a recumbent position; at times a sensation as though the heart stopped beating, accompanied by great anxiety, faintness, sinking at the pit of the stomach, and general coldness of the skin and extremities. Digitalis is undoubtedly deserving of great consideration in all forms of insanity where a general appearance of exhaustion and debility is attended by a slow pulse. Especially useful in epileptic mania; frequently when given at the beginning of the excitation cuts short the attack.

Gelsemium.—Paroxysms of frenzy; head hot, face flushed. eyes red and protruding; hair disheveled and a wild demeanor; talking and singing alternately; or there may be a desponding mood; great depression of spirits, with confusion of mind and excessive languor; desires to be quiet; does not wish to speak, nor have anyone near her for company. even if the person be quiet; dullness of the mental faculties; drowsiness. vertigo, and great muscular prostration; heavy, besotted expression; hands, feet, and head alternately hot and cold; tongue coated yellowish-white, with fetid breath; tongue trembles so he can hardly protrude it; numbness of the tongue, feels so thick can hardly speak; appetite capricious; bowels constipated; weakness and trembling through the whole system; complete relaxation and prostration of the whole nervous and muscular system, with entire motor paralysis.

Hepar sulph.—Violent, fretful, passionate; speaks with great volubility; hasty speech, words roll out, tumble over each other; hasty drinking; malicious mood; feels as if he could murder someone with pleasure; low spirited, even thoughts of suicide; impelled by unaccountable attacks of internal anguish, which come on quite suddenly, to attempt suicide; dementia, with complete stupidity; sits silent and speechless in a corner; heat and fiery redness of the face, or a yellowness of the face and skin; taste putrid, as of rotten eggs; tongue coated a dirty yellow; great desire for acids, especially vinegar; abdomen distended, tense; rumbling in the abdomen; stools white and fetid; clay colored. The chief characteristics of hepar are " hasty speech and hasty drinking."

Hyoscyamus.—Great mental excitement, with constant foolish talking, laughing, and singing; sings constantly and talks hastily, but indistinctly; sings amorous and obscene songs; raving, scolding; chatters day and night; insulting, shouting, brawling; ungovernable rage, with exhibition of unusual strength; wants to fight; attempts to bite; ferociously attacks all who try to appease him; strikes viciously at those about, and can scarcely be restrained; alternately ludicrous and solemn or furious; dresses in some fantastic way; sexual excitement, with inclination to remove the clothing and go about naked; face red and hot, or earthy pale; eyes red, wild, sparkling, with dilated pupils; wild, strange expression; patient refuses medicine; refuses to eat for fear of poison; tongue dry and parched; constrictive sensation in the throat, with inability to swallow; breath putrid; involuntary stools and urination. This remedy is especially useful in those cases of insanity with great nervous excitability without much cerebral congestion.

Ignatia.—Silent grief from disappointed love or mortification; excessive grief over losses real or imaginary; desires solitude, that he may nourish his sorrow; aversion to every form of amusement; tormented by remorse for imaginary crimes; senseless staring at one object, with sighing and moaning; great depression of spirits; fearfulness and timidity, alternating with great boldness and rashness; changeable disposition, laughing and crying almost in the same breath; easily angered, but quickly pacified; great inclination to have fixed ideas; sleep disturbed by dreams; moaning and groaning during sleep; tongue white, flabby, shows imprint of teeth; tongue trembles when protruded; bowels torpid; coldness of the extremities.

Lachesis.—Thinks she is somebody else, and in the hands of a strange power; she is under superhuman control; she is dead, and that preparations are made for her funeral; she is pursued by her enemies, or fears that the medicine is poisoned; depression, with a tendency to look constantly upon the dark side of life; peevish, irritable, and quarrelsome, with a disposition to find fault with others; great malice and spiteful tricks, all his thoughts tending to the injury of others, even to murder; great mental and physical exhaustion, especially in the morning; feels extremely sad, unhappy, and distressed in mind on waking in the morning. Lachesis is also useful in mania attended by excessive talkativeness; exceptional loquacity, with rapid change of the subject; jumps abruptly from one idea to another; talks, sings, or whistles constantly; wide awake, restless, and talkative at night; or restless sleep, with an aggravation of all the symptoms on awaking.

Lilium tig.—Crazy feeling on top of the head; wild feeling in the head, with confusion of ideas; listless, inert, yet does not want to sit still; restless, yet does not want to walk; hurried manner, desires to do something, yet feels no ambition; depression of spirits; constant inclination to weep, with fearfulness and apprehension of suffering from some terrible internal disease already seated; doubts her salvation; thinks she is doomed to expiate her sins and those of her family; disposition to curse, to strike, to think of obscene things; tears her hair, walks the floor night and day; seeks to escape; loss of appetite; aversion to food. This remedy is especially useful in those forms of insanity in women associated with uterine and ovarian irritation.

Mercurius.—Great restlessness, must constantly change his place; a universal uneasiness of the body, so that he could not remain one moment in the same posture; anxiety and apprehension; seemed as though he had committed a crime; suspicious, distrustful mood; looks upon everyone as his enemy; indifference to everything, even to taking his food; sleep restless, full of heavy dreams; tongue swollen, soft and flabby, taking impression of the teeth on its edges; tongue coated with a dirty-yellow fur; feels as if burnt; putrid odor from the mouth; region of the liver painful and sensitive to contact; abdomen hard, distended, and painful; clammy perspiration at night.

Nux vom.—Irritable, angry disposition; inclined to find fault and scold; morose, sullen, quarrelsome; violent upon the least contradiction; inclined to get angry or excited; or of a spiteful, malicious disposition; oversensitiveness to smell, light, strong odors, music, or talking; every harmless word offends; great depression of spirits; obstinate silence; involuntary sighing and moaning; inclined to commit suicide, but is afraid to die; sleep restless and unrefreshing; sad or frightful dreams; pursued by cats, dogs, and frightful objects; dreams of mutilations, of murders, of accidents, of quarreling; cannot keep from falling asleep in the evening; wakefulness in the middle of the night, followed by troubled sleep until late in the morning; morning sleep aggravates all complaints; pale, sunken countenance; slow pulse; loss of appetite; tongue coated white or yellow at the base; breath very offensive; in the morning mouth tastes badly, bitter or sour; flatulent distention of the abdomen after eating; constipation with ineffectual and frequent urging to stool; stools large, hard, dark or brown in color and knotty in appearance, consisting of little balls; alternate constipation and diarrhea.

Platinum.—Arrogant, proud, and reserved; possessed of the delusion of greatness and grandeur; everything and every person seems small and inferior; patronizes or treats with contempt all about her; considers none her equal, physically or mentally; very peevish and easily excited; everything seems strange and horrible to her; she thinks all persons are demons; thinks she is left entirely to herself, and stands alone in the world; it seems to her as if she does not belong to her own family; after a short absence everything seems entirely changed; tired of life, but great dread of death; changeable mood; one day joyous, the next sad; precordial anguish, with palpitation and fear of death, and of imaginary forms; sleeplessness from extreme nervous excitability; loss of appetite on account of depressed mood; or a ravenous appetite and hasty eating. This remedy is especially useful in erotomania and in those forms of insanity occurring in connection with menstrual derangements and sexual irritations.

Pulsatilla.—Silent mood; inclined to silent grief with submissiveness; sad, bursting into tears very easily; weeps, prays. and laments; full of anxiety; full of cares about domestic affairs; forebodings of impending disasters; fears that she might commit suicide; despairs of her salvation, and seeks aid in constant prayer; folds her hands, and sits like a statue; restless sleep, with sensation of heat; wide awake in the evening; first sleep restless; sound sleep when it is time to get up; wakes languid and not refreshed; vivid, frightful dreams; violent palpitation; oppression of breathing; sensation of dyspnœa in the lower portion of the chest, as if it were too full and tight; pale, earthy complexion, with desponding looks; dark rings around the eyes; no appetite; tongue coated with tenacious mucus, white or yellow; dryness of the tongue, as if burnt; without thirst; chilliness through the whole body, especially in the back, with cold hands; limbs feel as if asleep; great weariness and prostration.

Plumbum.—This remedy is especially called for in general paresis. The indications calling for its use are: Wrist drop very prominent and pronounced; wasting away of muscles;

humerus seems covered only by integument; can walk only with assistance; paraplegia; paralysis, preceded by mental derangement, trembling, spasms; or by shooting, darting, intense pains in the tracts of the larger nerves; great hesitation of speech, tremor of the tongue, exaltation of ideas, emotional disturbance and restlessness; urine scanty and high colored; icteroid appearance; no appetite; thirsty; paroxysms of intense colic, with retraction of the abdominal walls, and often vomiting; obstinate constipation; has desire, but not power, to evacuate the bowels; injections sometimes enables him to pass small, hard balls.

Sepia.—Passionate, irritable; great irritability from the slightest causes; very easily offended; great irritability, alternating with indifference; greatest indifference to everything; the death of a near relative or some happy occurrence leaves her equally unaffected; no trace of her former love for her friends, or even for her family; aversion for social intercourse amounting to contempt; restless sleep, disturbed by anxious dreams, awakening in fright; yellow spots on the face; yellow around the mouth; canine hunger, or no appetite, nothing tastes well; tongue coated white or a dirty yellow; a peculiar faint, sinking emptiness or goneness at the pit of the stomach; pressure in the stomach, as from a stone; abdomen bloated; a feeling of bearing down of all the pelvic organs. This remedy is especially useful in women whose insanity has been caused by uterine or ovarian irritations.

Stramonium.—Mania; furious, raving, wild attempts to strike and bite; great desire to bite and tear himself with his teeth; wants to bite those around him; paroxysms during which he threatens to knock everybody down, to break furniture, to throw himself out of the window, tears his clothing; attempts to escape with shrieks; screams or howls in a high voice; frightful visions, men, ghosts, dogs, cats, bugs, and flies springing up around him; his features express fright and terror; converses with spirits, with absent individuals as if they were present, and addresses inanimate objects by names of such persons, but observes none of those standing about him; face red; eyes wild and staring; pupils dilated and insensible to light; sleeplessness, or sleep disturbed by frightful dreams; lips tremulous; tongue immovable or protruded with difficulty; inability to swallow, or swallowing with difficulty. The symptoms calling for this remedy often present the strongest contrariety; love, hate, fear, rage, laughter, loquacity, moaning, or taciturnity occurring without order and in quick succession.

This remedy is also indicated in those cases where there are alternations between exalted states and settled melancholia. The patient sits silent, with her eyes fixed on the ground, as if absorbed in contemplation; stares stupidly; looks vacantly around; possessed of strange, absurd ideas; thinks herself tall or double; that one-half of the body was cut off; looks pious; is constantly praying; despairs of her salvation; is restless and sleepless at night.

Stramonium is especially useful in those forms of insanity characterized by more intense excitement than hyoscyamus or belladonna, and with less cerebral congestion.

Sulphur.—Melancholia; dwells on religious and philosophical speculations; anxiety about his soul's salvation, indifference about the lot of others; variable mood, one moment crying, the next laughing; foolish happiness and pride; thinks herself in possession of beautiful things; even rags seem beautiful; dresses herself in rags, and imagines that she is beautifully clothed; destroys her clothing, as she imagines that she has abundance of everything; drowsy during the day and wakeful at night; face pale, sickly looking; eyes sunken; flashes of heat; feet cold or burning in soles of feet; faint, weak sensation in the stomach about 11 a. m.; much thirst, with little appetite; constipation with hemorrhoids; or a tendency to early morning diarrhea.

Tarentula.—Great taciturnity and irritability; desires to strike himself and others; consciousness of unnatural state of mind, hence despondency, sadness, moral depression, and disgust for everything; loss of appetite; general prostration; restlessness of the hands and legs; constant movement, cannot remain in one place; disposition to joke and laugh, and to play tricks, with impulsive movements; sudden fox-like and destructive efforts, requiring the utmost vigilance to prevent damage; followed by laughter and then apologies; all the symptoms relieved by music; screams, sings, bites, throws things violently about, springs out of bed, destroying whatever she can get hold of.

Thuja.—Fixed delusions; as if a strange person were at his side; as if soul and body were separated; that the body, particularly the limbs, are made of glass, and will readily break; does not want anybody to come near him or to touch him; delusions as if a living animal were in the abdomen; talks about being under the influence of a superior power; the patient tenaciously harping on that one fixed idea; speaks slowly and in monosyllables; uses wrong words or omits words and syllables; sleeplessness at night; restless and tossing about; sleep full of dreams and startings; no appetite, or a craving, alternating with a want of appetite; abdomen puffed and large, and motions therein as if it contained something alive; constipation; stools in hard balls; stools large, thick, and knotty; hard, followed by soft, stools.

Veratrum album.—Mania, with desire to cut and tear things or clothes; wild shrieks, with disposition to bite and tear; a tendency to violent outbreaks; desires to strike those about him; attacks of rage and swearing; lewdness and lascivious talk; void of shame; constant laughter, alternating with lamentations and howlings; cursing and howling all night; extreme liveliness and extravagance of ideas; singing and clapping the hands. The patient passes from this state of frenzy into one of deepest melancholia; abject despair of salvation; melancholia, with anxiety as if he had committed a crime; talks much on religious subjects; prays, weeps, and despairs of salvation; patient sits in a stupid manner, with the head bent forward, taking no apparent notice of anything, answering in monosyllables, or not at all; moaning during sleep; face pale, bluish; eyes fixed and sunken, with blue or green circles around them, a wild and restless look; cold sweat on face and forehead; skin blue and cold; tongue pale, cold, white with red tip and edges; coated yellow on the back part; appetite voracious or will not eat unless fed; great sinking and empty feeling in abdomen; pulse frequent, small and weak; often intermittent, at times almost imperceptible; constipation or exhaustive diarrhea; patient in a complete prostration of mind and body; utter collapse. Veratrum alb. is one of our most important remedies in the treatment of insanity, especially in those cases characterized by excessive weakness and sudden sinking of the strength.

In conclusion we would say, do not become discouraged too quickly; for you must take cognizance of the fact, and impress the same upon the friends of the family, that the course of the affection is naturally slow; further, in the treatment of these cases of insanity, treat the *mental illness* upon the same principles that you would a *physical illness*, namely *similia similibus curantur*.

Idiocy and Imbecility.

By the terms "idiocy" and "imbecility" we are to understand those conditions in which a state of mental weakness has existed from birth or from early childhood—that is, the enfeeblement resulting from want of brain development before birth or from a damaged brain after birth. Ireland's definition is: "Idiocy is a mental deficiency or extreme stupidity, depending upon malnutrition of the nervous centers, occurring either before birth or before the evolution of the mental faculties in childhood." Imbecility is generally used to denote a less decided degree of mental incapacity.

Spitzka says that it is customary to distinguish three grades, as follows: "To the subject deprived of all higher mental power, and who is unable to acquire the slightest accomplishment, the term *idiocy* is applied. He who is capable of acquiring simple accomplishments, but unable to exercise reasoning power beyond the extent of which a child is capable, is designated an *imbecile*. Finally, there is a large class of subjects who are defective as to judgment, and in whom this defect is of similar origin too, though not as intense as that of imbeciles and idiots, and who are termed *feeble-minded*."

Idiocy may be congenital—that is, certain causes have operated to produce this condition before birth—the causes having originated during intra-uterine life; or it may be acquired, the result of causes checking the mental development in early childhood (within the first seven years).

Idiocy differs from dementia in the fact that in dementia there is a gradual and progressive deterioration of the mental faculties that at one time existed; while in idiocy the mental faculties never existed, the brain being damaged to such an extent as to be incapable of producing them.

Causes.—Heredity is a great factor in the production of idiocy and imbecility. Ireland says: "Idiocy is of all mental derangements the most frequently propagated by descent." Insanity, epilepsy, hysteria, etc., in the parents may develop into idiocy in the children or grandchildren. Consanguineous marriage, where there is a strong neurotic taint, is liable to produce idiotic and weak-minded children. Where parents are too old or too young, or addicted to drunkenness, or where there is a syphilitic taint or a tubercular tendency, it may result in idiocy or imbecility. Idiocy may be due to imperfect development of the brain, as a whole or in portions; certain parts may be absent, most frequently the anterior lobes; there may be inequality of the two halves of the brain, or the brain may be abnormally small—what is termed a microcephalic brain. In fact, there is scarcely any portion of the brain which has not been found either altogether absent or in quite a rudimentary state.

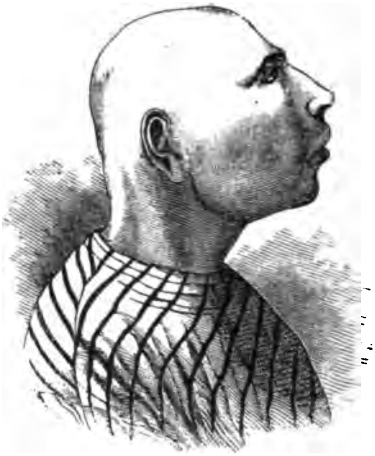

FIG. 84.—MICROCEPHALIC IDIOT. (After Ireland.)

Disease or injury befalling the brain before or after birth, such as local or diffuse encephalitis, meningitis, hemorrhage, porencephaly, cerebral hypertrophy or atrophy, blows on the head causing a shock, injuries to the head at birth from prolonged and difficult parturition or from the use of forceps, injuries to the unborn child by attempts to procure abortion, convulsions of children from teething or other causes, all may induce cerebral changes which render the brain incapable of higher development, and leave the child in a state of idiocy or imbecility—often the child remains a mute. Epilepsy in very early childhood (before the seventh year) may result in idiocy or imbecility. Hydrocephalus may result in idiocy. The accumulation of fluid pressing on the brain deranges its function and eventually causes it to atrophy. Microcephalus always produces congenital idiocy. Deprivation of two or more of the special senses is sometimes given as a cause of idiocy; in that case, in the strict sense of the word, the child could not be called an idiot, but in many cases it is an idiot as far as its relation with the outer world goes. M. Tripier states that only one-fifth of deaf-mutes are so from birth, and that four-fifths become so after the age of two or three years. Fright to the mother or other painful emotion during pregnancy is very often assigned as the cause of idiocy. In many cases the cause of idiocy cannot be explained.

In idiocy there are varying degrees of intelligence, from the individual who can neither speak nor understand speech, to the one who can read, write, and possesses enough intelligence to be self-supporting. In some instances the idiot is but an automatic being, without any evidence of the actions of the higher centers whatever; there is complete unconsciousness of the world and of time; he is unconscious of all that goes on around him; he is never able to walk, nor perform any voluntary movements, the only movement being the opening and shutting of the mouth. Such an idiot would die of starvation unless food were placed in his mouth. There are others who are able to make use of a few words or of short sentences. In the lighter forms (imbeciles) many are capable of learning, are quite apt in acquiring facility in using tools, and may learn to be self-supporting.

Some show special talents in certain directions, as, for instance, the celebrated negro musician known as Blind Tom. This person was not only blind from birth, but was little above the brute creation in point of intelligence. Yet his musical capacity was prodigious. Almost in his infancy it was discovered that he could reproduce on the piano any piece of music that he had ever heard. Another instance showing the abnormal development of a special talent is that of the mathematical prodigy, or, as he is sometimes called, the "lightning calculator." As an example of this class, we would cite a case (near this vicinity) where the individual was able to give the amount of a long column or columns of figures instantly. In addition to this faculty, he possessed that of being able to tell the time of day almost accurately without either looking at the clock or the sun. An enterprising relative conceived the idea of exhibiting him before the public, but, on his first appearance upon

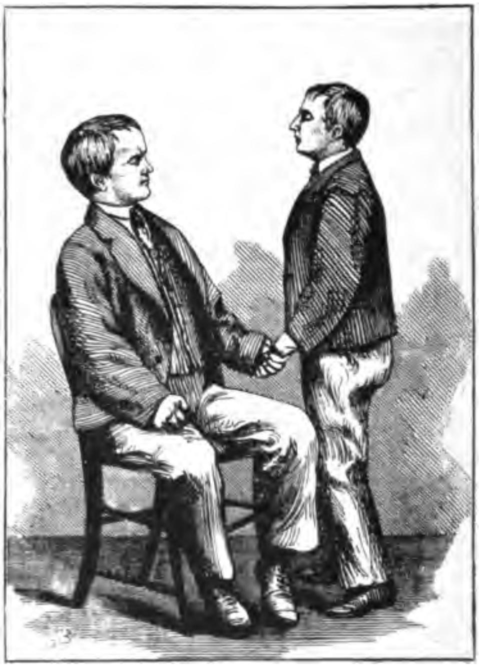

FIG. 85.—HYDROCEPHALIC AND MICROCEPHALIC IMBECILES.

the stage, his manager, unfortunately, referred to the fact that, aside from the above-named faculties, the man was a perfect fool. Whereupon the aforesaid idiot promptly knocked him down, saying that he was not " a fool," but " the wisest man on earth." Incidentally it might be remarked that this ended his stage career. Other cases show special talents for drawing; still others show quite a faculty for imitating what they see others doing. Their memory for certain events is sometimes phenomenal. Dr. Forbes Winslow relates the case of a man who could remember the day when every person had been buried in the parish for thirty-five years, and could remember with unvarying accuracy the name and age of the deceased and the mourners at the funeral; but he was a complete fool; out of the line of burials he had not an idea—could not give an intelligent reply to a single question, nor be trusted even to feed himself. Many of these individuals display considerable shrewdness, are droll in behavior, and are always ready with a repartee. It is to this class of persons that the term half-witted is usually applied, and it was from this class, also, that the " court fools " were drawn.

Many idiots can hum tunes correctly, but cannot speak a word, and cannot even understand speech. The lower class of idiots never learn to speak at all. " Idiots seldom learn to speak if they do not begin before they are six or seven years of age." (Ireland.) Many idiots remain all their lives children in intellect; often so in their feelings, desires, and actions. The special senses are more or less imperfect or entirely wanting. Many idiots are deaf or mute, or both; hearing, as a general rule, is not as defective as it apparently is; they hear, but do not pay attention; many are blind, and in some smell is imperfect. In the majority of idiots taste is deficient or absent; they generally eat whatever is placed before them.

The general sensibility is impaired, and in some cases there is actual anæsthesia. Abnormal sensations, so common with lunatics, are not often met with among idiots.

Congenital idiots, as a rule, have an awkward, clumsy, and disproportionate body, and the height is somewhat below the average of his age. The head is narrow and slightly asymmetrical; the occiput is very straight; ears far back, widely projecting, flat or irregular in shape, and of large size; the eyes are closer together than normal, lips thick and everted, teeth irregular and decayed, the upper jaw is narrow, and the roof of the hard palate is vaulted or keel-shaped. According to Clouston, the arch of the hard palate will be found to be abnormal and V-shaped in sixty-five per cent. of all idiots and congenital imbeciles. The lower jaw does not extend as far forward as the upper jaw, and a receding chin results. The facial expression of these cases is characteristic—the vacant stare, the foolish and expressionless countenance, features repulsive and old-looking. The trunk is bent forward, and the gait is peculiar—a slovenly, stooping, an awkward, stumbling, or a shambling, shuffling gait, and it is late in childhood before they learn to walk at all.

Puberty is usually late in appearing; in girls the menses may not appear until after the age of twenty, or may never appear at all. In the lower grades of idiocy the sexual organs are rudimentary or deformed, or may be entirely absent. In many of these cases sexual life is but slightly developed, and there is impotence, as the case may be. Those cases in which the sexual appetite is developed may attempt to satisfy it on the nearest relative, and if opposed, become greatly excited and may commit murderous assault on the person attacked. More frequently, however, they resort to onanism, which may be practiced openly and shamelessly, without regard to place or circumstance; or, again, they may attempt to satisfy their sexual appetite with animals. Most congenital idiots and imbeciles grow old soon.

In acquired idiocy or imbecility the general appearance of the individual may present nothing abnormal; his expression is intelligent; his gait is normal; he is well formed; he is restless, constantly on the go; into all kinds of mischief; is impatient of restraint and self-willed; screams or stamps his feet, flies into a rage, and never ceases to give trouble or care.

MICROCEPHALIC IDIOTS.—This is a term applied to idiots whose heads are less than seventeen inches in circumference. Below seventeen inches in circumference the manifestations of intellectual power would necessarily be feeble.

In some instances the head may be, as the saying is, no larger than a "turnip." The bodily stature is generally below the medium, many of them being mere dwarfs. They are usually bright and intelligent-looking, extremely lively, very imitative and inquisitive, easily excited, and very capricious. They may learn to read and count a little, and many of them can speak correctly. This is the class of individuals exhibited from time to time by showmen, with a trumped-up story about their origin, as belonging to some lost race or to people living in trees, etc.; for instance, the two children exhibited some years ago as the reputed remnant of the extinct American Aztec people. Microcephalic idiots are always congenital idiots.

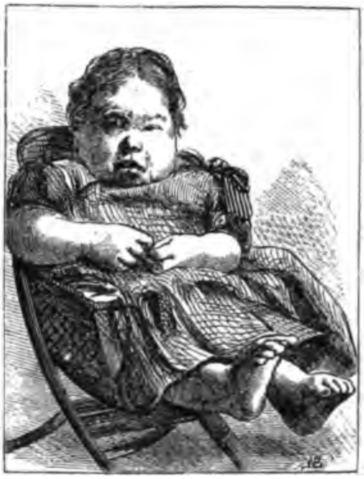

FIG. 86.—CRETINOID IDIOT. (After Ireland.) Age of patient fifteen years; height thirty-eight inches; weight sixty-three pounds.

CRETINISM.—Cretinism is a special kind of idiocy, usually occurring in connection with goiter; yet not all cretins have goiters. Every cretin is an idiot, but every idiot is not a cretin. It is an endemic disease, and is met with more frequently in the Swiss mountains and the Pyrenees; yet no quarter of the globe is free from it. (It is also found in France, Austria, China, and in the Rocky Mountains of this country.)

It affects males more frequently than females. Cretinism has a close connection with goiter. " Nowhere does cretinism occur where goiter is absent, but goiter may occur where cretinism is unknown." (Ireland.)

The specific cause of cretinism is not known; many theories have been advanced; some claiming that it is due to a specific toxic cause of miasmic nature; others that it is due to humidity of the soil and air—dark, damp valleys. " There are close valleys where more than half the children born become cretins." (Ireland.) There seems to be some relation between limestone districts and the presence of cretinism. Cretinism is not necessarily hereditary. Cretinous or goitrous parents may produce cretins if they remain among their native mountains; but if they leave the cretinous district, in the majority of cases they leave behind them the danger of having cretin children. In many instances, where the children are removed in early childhood and kept away from the cretinous district, they escape the disease entirely. So well has this fact become established that in many cretinous districts they send the children to a higher elevation to be nursed—to what are called nursery farms, established for this purpose.

Aside from those individuals directly affected with the disease, the whole population is, to a greater or less degree, subject to its baneful influence; it affects them both physically and mentally. Every degree of weak-mindedness may occur with cretinism; but, as there is nothing in the intellectual state of cretins to distinguish them from other idiots, it would not be necessary to describe the varying degree of intelligence, as this has already been done when describing the other forms of idiocy.

In rare instances the child is born a cretin, but more usually the symptoms do not begin to manifest themselves until within three to eight months, and then gradually become more distinct. Seldom does a child develop cretinism after the seventh year. The child in early infancy may appear perfectly healthy, but as the disease progresses it becomes fat and does nothing but eat and sleep; the countenance becomes stupid and expressionless; the head is large and deformed; the eyes are widely set apart; the nose is broad and flat, and depressed at the root; the mouth is usually open; the lips thick; the tongue thick, and occasionally protruded; the neck is short and thick; the hands and feet are broad and thick, and the stature short and thick. In the majority of these cases dentition is slow and difficult; the teeth coming irregularly and decaying soon, and in many cases second dentition never takes place. Many of them do not learn to walk until they are six or seven years of age. Goiter is usually present in these cases.

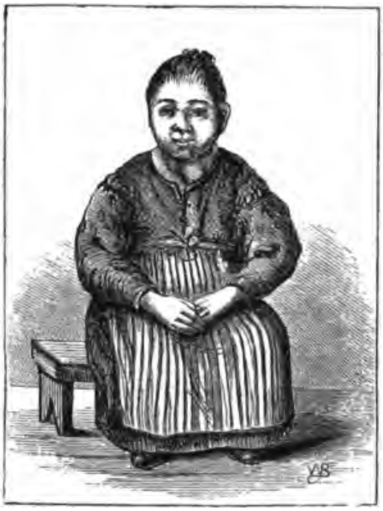

FIG. 87.—**FEMALE CRETIN.** Patient aged nineteen years; height thirty-nine inches. She never presented any sign of puberty.

The child in appearance grows old soon. The features are coarse and repulsive and old-looking; the skin is often dark and rough, and appears to be thickened; hangs in folds, as though it was too large for the body, which it loosely covers. Cretins rarely attain the usual height; many are dwarfs, no higher than three feet. Hearing is usually very defective and taste and smell deficient; speech thick and coarse; many cases being deaf and dumb. The general sensibility is diminished; frequently cretins are insensible to both heat and cold. Puberty is usually delayed or absent; rarely do cretins develop in stature after the age of twenty-one. Cretins of the lowest form never have children, because the males are almost always impotent—in many cases the testicles being entirely absent; the women are sterile. There is another type of cretins whose bodily configuration and stature is just the opposite of those just described; their heads are microcephalic (less than seventeen inches) and in height they range from six to eight and one-half feet. There are still other types in which the physical deformities are not so great as those just described.

Idiots, as a class, are usually merry and good-humored, completely free from care, and lead an easy and happy life. The lower grades may be educated up to a certain point, and may gain a slight command of language and some imitative power. The higher grades are capable of being taught to read and write, and in many cases to be self-supporting. There is more hope of improvement in a congenital idiot or imbecile than from acquired idiocy or imbecility due to a damaged brain. Idiocy due to epilepsy is usually more susceptible of treatment than the other forms, but the great drawback is that what has been learned may be partially or entirely forgotten after an epileptic attack, the child having to begin and learn it all over again.

In cretinous idiocy the only hope lies in early removal from the dangerous neighborhood. Recovery is not possible.

Idiocy and imbecility are diseases which the general practitioners have very little to do with, as the treatment of such cases is usually carried out by institutions especially adapted for this work; yet it is as necessary for them to have a general knowledge of this as any other disease, so that they may be able to outline a general plan to pursue in order to get the best results.

SEXUAL PERVERSIONS.

In the great majority of instances sexual perversions may be looked upon as a general deterioration of the race. Large cities, especially, are the breeding-places of this degenerate sensuality. Rarely, if ever, does it occur in uncivilized races. Many varieties of sexual perversions are congenital; others may be either congenital or acquired. Sexual perversion is much more frequent in men than in women.

Sadism.

Sadism (so named after the notorious Marquis de Sade, a French writer, who wrote obscene novels, filled with lust and cruelty) is that form of sexual perversion where the member of one sex endeavors to give pain and exercise force upon the other sex during or following the sexual act; in other words, it is a desire to injure and humiliate the opposite sex during the sexual act. Sadistic acts vary in degree from lust-murder to the mere act of causing pain by pinching, pricking with pins, etc., or even to an act that is apparently quite senseless and silly. Lust-murder is where an impulse to attack the female body is connected with lust. "Accompanying this lustful emotion there is an impulse not only to subdue absolutely the object of desire, but even to destroy or kill it." (Kraft-Ebing.)

After committing the sexual act, they choke them, stab them in the abdomen, or perform other atrocious acts, then murder them, cut them open and wallow in the intestines, or cut out the genitals and carry them away; they may eat the flesh of the murdered victims and masturbate while so doing. "Jack the Ripper," the Whitechapel murderer, was undoubtedly a sexual pervert of this class, and the mutilation of the bodies was the regular gratification of the perverted sexual desire. In some instances the sexual power can only be excited by making a cut, and then sucking the blood, and during the act becoming sexually excited. According to Kraft-Ebing, the greatest pleasure of the Marquis de Sade was to injure prostitutes and then bind up their wounds. Coitus only excited him when he could prick the object of his desire until the blood came. In other cases the sadistic impulse toward women is expressed by throwing vitrol, ink, etc., upon them; also by the desire to defile them with disgusting and foul things, as to urinate on them, or to cover them with their fæces.

Suffering of any living object may act as a sexual excitant to these individuals. In many instances they carry chickens, geese, etc., to houses of prostitution, and during the sexual act kill them, the sight of the dying victim and its death struggles being the only means of exciting their sexual passion.

Masochism.

Masochism is so named from Sacher-Masoch, a writer whose romances and novels have as their particular object the description of this form of sexual perversion. Masochism is the very opposite of sadism. Just as in sadism men excited and satisfied themselves by subjecting women to pain and humiliation, so in masochism the same object is sought in the passive reception of similar abuse; in other words, it is the feeling of humiliation and slavish subjection that gives the pervert lustful pleasure.

The consciousness of subjection and humiliation before women is the most important element of masochism. They will submit to all kinds of humiliating and degrading acts from females; have themselves whipped, trod upon, beaten, pricked with knives; will suck the toes of the dirtiest woman that they can find, lick the genitals of prostitutes, etc.

Homo-Sexuality.

(*Contrary Sexual Instinct, Urnings.*)

Homo-sexuality is that form of sexual perversion in which the individual conceives a violent sexual passion for one of the same ,sex. They gratify their sexual passion by passive and mutual onanism, by coitus between the thighs, or with platonic love. Sexual intercourse with the opposite sex does not satisfy them, and in the majority of cases they have a horror and disgust for the act or even incapability of performing it. To sleep with a woman would neither excite nor give them pleasure; but to sleep with a man fills them with an intense feeling of lust. Many of them like to wear female attire, and the happiest moment of their lives is when they can be fully bedecked with female finery; many even keep a full outfit of female wearing apparel in their rooms. Some have a special liking for female occupations, as sewing, crocheting, etc.

This class of sexual perverts is quite large, every city numbering them by the scores, and even hundreds (so called women-haters). They have their meeting-places and so called promenades. They can usually recognize one another, although entire strangers, by some peculiar look, act, or manner of walking, which they are unable to describe to one not initiated, so that he would be able to detect them. They have their love-affairs, betrothals, marriages, and in many instances live together as "man and wife." In many cities male prostitutes are to be met with, who walk the streets and practice passive pederasty.

Sodomy is a term sometimes used synonymously for bestiality, but, in the strict meaning of the term, it signifies unnatural intercourse between persons of the same sex.

Pederasty is that form of sodomy where the sexual act is performed by *immissio penis in anum*. Many female prostitutes are passive pederasts. On anal examination of 446 prostitutes, Dr. Coutagne found the signs of post-perineal coitus in 180. He cites the case of a young prostitute presenting the astonishing contrast of a gaping anus surrounded by characteristic rhagades, with the genital parts of an extreme freshness, a very narrow vagina, and non-retracted hymen, constituting by their reunion a still firm ring.

Bestiality is the intercourse of human beings with animals.

Homo-sexuality is also met with, although not so frequently, in the female sex. There are several instances on record where marriages have been contracted, the parties living together as husband and wife, the ruse being detected only by accident or deathbed confession of one of the parties; there are also instances where one of these sexual perverts has passed herself off for a male and contracted marriage with innocent and unsuspecting girls. The manner of sexual satisfaction in female perverts may be mutual and passive masturbation. To them coitus is quite as disgusting and as unsatisfactory as it is to the male perverts. They have their love-affairs, as do the male sexual perverts, and their only wish is to " live always with the female friend."

Erotic Fetichism.

A fetich (a charm) is a material thing, living or dead, which is made the object of brutish and superstitious worship. " Fetich " is a word first applied by Portuguese traders to objects worshiped by the natives on the west coast of Africa.

Erotic fetichism is a form of sexual perversion in which the feelings are excited either by a certain portion of the body of the opposite sex, as the eye, the mouth, the hand, the foot, the hair, or by some article of wearing apparel of the opposite sex, as a garment, a handkerchief, a shoe, etc. All sexual interest is concentrated upon these fetich objects; everything else feminine fades, and all other sexual value of woman sinks to *nil*, so that instead of by coitus, an orgasm is obtained by touching or manipulating these fetich objects; the woman herself could not excite the sexual stimulus, the sexual interest being concentrated upon these fetich objects. To this class belong the greater number of hair despoilers (cutting off the hair of young girls and women on the streets, etc.), handkerchief-stealers, shoe-stealers, etc. P. Garnier * reports a curious case of sexual perversion where the patient had an uncontrollable desire to touch the silk clothing of women; females not garbed

* " Annual of Medical Science," 1894.

in silk had no attraction for him. There is another class of sexual perverts who can only excite the sexual functions by feeling fur or velvet during the act of coitus.

Androgyny and Gynandry.

These terms include those individuals who, in addition to their sexual perversion, resemble the opposite sex in their physical appearance, in voice, in action, and in their mode and manner of living, so far as they can.

Necrophilism.

Necrophilism is that form of sexual perversion in which dead bodies are violated. Such sexual perverts prefer a corpse to a living woman.

Treatment of Sexual Perversion.—As to treatment, we would simply say that as the problems of perverted sexuality are so satisfactorily solved by the application of orificial principles to chronic diseases, this would be the first line of conduct. It will almost invariably be found that some form of rectal or sexual irritation is at the basis of all cases of perversion of sexual instincts, and removal will be the first step in placing the patient on the road to recovery; but, as Professor Pratt says, where morbid habits of body have instituted morbid habits of mind, and the two have lain down together, a cure implies a regeneration of the soul as well as a rebuilding of the body; a correction of habits of heart and mind as well as those of matter: and it is in these cases that the doctors who rely solely upon physical work and are ignorant of or discard the profound action of mind over matter are doomed to ignominious failure in their professional work.

Suggestive Therapeutics.

(*Hypnotism, Mesmerism.*)

The word "hypnotism" is derived from the Greek word *hypnos*, which, literally speaking, signifies sleep; but this is not the sense in which the term is employed in speaking of hypnotism, for many times the subject may be in an hypnotic state and merely feel sleepy, or feel a numbness or pricking sensation or "queer feeling," as they often express it. The hypnotic state or states may be induced in a number of ways.

The *Nancy school* employs oral suggestions. The subject is placed in a chair in front of the operator, and then the operator, in a firm and confident tone of voice, tells the subject that he will go to sleep in a short time; that he feels a sort of drowsiness; that he is going to sleep; that the eyelids are closing; that they are closed; that he cannot open them again; that he must think of nothing but sleep; that he cannot feel anything; that his arms are heavy, so are his legs; then adds, in a commanding tone, "sleep," and ofttimes the subject immediately goes off to sleep.

A simple word does not always suffice in impressing the idea upon the mind. It is sometimes necessary to reason, to prove, to convince, and in some cases to affirm decidedly. Often the process can be facilitated by gently closing the subject's eyelids and holding the fingers on them for a few minutes.

The hypnotic state may be also induced by commanding the subject to look at a bright object, watching the pupils of his eyes, and, at the right moment, commanding him to close them, telling him at the same time that he cannot open them.

The fascination method consists in the operator holding the attention of the patient by directing him to look straight into his own eyes, and then telling him to imitate any movement made by the operator.

It has been demonstrated that fixed gazing upon an object, held in such a position as to cause the eyes to be strained upward, is the easiest way to induce the hypnotic condition.

Braid hypnotized all of his patients by having them look fixedly at a bright object held or fixed at a distance of six or eight inches from and a little above the level of the eyes, so as to tire the ocular muscles.

Stroking the forehead from above downward to the root of the nose with the index finger, and at the same time gently closing the eyelids and pressing gently through the lids upon the eyeballs, will often succeed when all other measures have failed.

The *Mesmeric school* claims that there exists in man a subtle fluid in the nature of magnetism, which, by means of passes over the head and body of the subject, accompanied by entire concentration of mind and will on the part of the operator, can be made to flow from the ends of his fingers and impinge upon the subject, producing sleep and all the varied subsequent phenomena at the will of the operator. The method of producing the passes is as follows: The operator, having his fingers slightly bent, commences at the top of the head of the subject and passes his hand slowly downward over the face, chest, body, lower extremities, and feet, not touching the person, but keeping the tips of his fingers at a distance from a few inches to two or three feet away. Many persons so treated claim that they are able to feel these passes, more or less distinctly, and describe the sensation produced as a breeze or current; sometimes designated as warm, sometimes as cool, and sometimes as the "pins and needles" sensation. It is, in all probability, the subject's imagination alone which is rendered active and which causes all these phenomena.

It is recommended, for several reasons, that the mesmeric passes be employed. On this point Hudson * says: "First, they are so generally believed to be necessary that they greatly assist by way of suggestion. Secondly, they are a great assistance to the operator, as they enable him more effectually to concentrate his mind upon the work in hand, and to fix his attention upon the parts which he desires to affect. Thirdly, they operate as a suggestion to the operator himself, which is as necessary and as potent to effect the object sought as is suggestion to the subject. Fourthly, whether the fluidic theory is correct or not, the power, whatever it is, appears to flow from the fingers; and, inasmuch as it appears to do so, the effect, both upon the mind of the operator and of the subject, is the same as if it were so—the great *desideratum* being the confidence of both." Thus we see that mesmerism is the most powerful of any of the known methods of mental healing, for it combines oral suggestion with mental suggestion.

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* "The Law of Psychic Phenomena."

That suggestion is the all-potent factor in the production of all hypnotic phenomena is now universally recognized. The suggestion may be either expressed or implied; that is, expressed orally in the form of an assertion or command, or may be implied by the actions of the operator—for instance, passes, etc.

In order to awake the subject, it generally suffices to say, "Wake up," or "Your eyes are opening; you are awake." Sometimes snapping the fingers or blowing once or twice on the eyes causes the subject to awake; or again, by telling him to count up to ten, and that when he says "ten" he will be awake; the moment he says "ten" his eyes are open. Some subjects can be awakened by suggestion after a specified time. It is enough to say, "You will awake in five minutes"; they awake precisely at the moment suggested.

Often after a subject awakens he complains of a fullness in the head, a dizziness, or a dull headache. These disagreeable sensations can be prevented by suggesting to the subject while in the hypnotic state that when he awakes he will not feel any headache or any disagreeable sensations; that he will feel perfectly well.

Some subjects remember everything that occurred during the hypnotic state; others retain only a vague or incomplete memory; while still others have no recollection whatever of what transpired during that period, all being a blank to them; this latter state is called somnambulism.

The power to mesmerize or hypnotize is within the reach of anyone with sufficient intelligence to understand the directions, and the determination to follow them with persistency. One great factor is self-confidence; without this the operator will invariably fail. This self-confidence can be strengthened by auto-suggestion.

The general impression seems to prevail that the mesmeric power is exercised by compressing the lips, corrugating the brows, and assuming a fierce, determined aspect, such as is practiced by the majority of "public mesmerists." The fact of the case is that it *does not* require mental or nervous strain for the successful exercise of the so called will-power, but, on the contrary, a calm serenity of mind.

It is not always possible to bring a subject completely under the hypnotic influence at the first trial; in fact, the majority of cases have to be educated up to it by successive trial, each time being more influenced and passing deeper into the hypnotic state.

Much has been said and written of the relation of hypnotism to crime. It is difficult to understand how anyone who recognizes the law of suggestion and its universal application to psychological phenomena can believe for one moment that hypnotism can be made the instrument of crime. The consensus of opinion goes to show that no subject can be induced to commit a crime or an immoral act through hypnotic influence unless such subject is predisposed to such crime or immorality, for auto-suggestion protects the morally pure and the virtuous. Hudson, speaking of this subject, says: "If the subject is a criminal character, he might follow the suggestions of a criminal hypnotist, and actually perpetrate a crime. In such a case, however, a resort to hypnotism for criminal purposes would be unnecessary, and no possible advantage could be gained by its employment. Also the same rule applies to sexual crimes; and it may be set down as a maxim in hypnotic science that no virtuous woman ever was, or ever can be successfully assaulted while in an hypnotic state."

It is impossible to obtain vital secrets from persons in an hypnotic state; consequently testimony obtained from an hypnotized subject, in a court of justice, as regards the guilt or innocence of himself or his friends is of no evidential value whatever. The reason for this is that the instinct of self-preservation, always alert to avert any danger which threatens the individual, steps in to his defense.

As regards the therapeutical application of hypnotism or suggestive therapeutics to relieve or modify functionally diseased states, and even organic, to a more limited extent, the results are often quite brilliant.

In speaking of the application of suggestive therapeutics we do not mean merely its application to a subject while in the hypnotic state, for the relief of various functional troubles, such as functional paralysis, anæsthesia, the various neuralgias, etc., but also the more general sense by which it is employed by every physician in his daily practice. Every successful physician is a conscious or unconscious hypnotist—that is, he employs suggestive therapeutics, whether he recognizes it or not; in fact, we all use suggestive therapeutics every day of our lives. The physician who, believing implicitly in the efficiency of his treatment, and who never prescribes a dose of medicine without giving positive assurance of the beneficial results that will follow, will count a higher percentage of cures than the skeptical and timid practitioner. By a firm and confident manner and a quiet, persuasive voice a physician is often able to drive away from the patient's mind the great anxiety which consumes him, dispel his discomfort, sustain his courage, increase his confidence, and restore him as by a salutary balm.

The time is at hand when mental therapeutics must be recognized and used as any other agent we have for the amelioration and cure of disease. Even though the disease be a grave one, still the mind can exert a powerful influence for good, and it is the physician's duty to use all the means in his power to promote the cure of his patients. True, psycho-therapeutic suggestion may fail, as other agents do, but it often succeeds when other means have failed.

THE SYMPATHETIC NERVOUS SYSTEM.

The term " sympathetic " was originally applied to this system of nerves from the belief that through them a sympathy was produced between different organs—that is, when one organ was diseased, another was brought into sympathy with it.

The sympathetic nervous system is much simpler in its construction than the cerebro-spinal system. Like the cerebro-spinal system, the sympathetic is composed of centers, or ganglia, and nerves. The ganglia contain nerve-cells, most of which differ but little from the cells of the encephalon and spinal cord. Like the cerebro-spinal, it possesses afferent nerves of sensation, which are distributed to the various mucous membranes of the body, and efferent nerves of motion, which supply the entire involuntary muscular system. These nerves are composed of fibers, some of which are nearly identical in structure with the ordinary motor and sensory fibers, while many are the so called gelatinous fibers.

The sympathetic nervous system consists of (1) a series of ganglia connected together by interrupting cords, forming a double chain (one cord on each side of the vertebral column), which extends from its origin within the skull to the coccyx; (2) gangliated plexuses or aggregations of nerves and ganglionic cells; (3) nerve fibers.

The sympathetic cord, as it is sometimes called, consists of 28 pairs of ganglia and one single ganglion (ganglion impar); namely: 4 cranial, 3 cervical, 12 dorsal, 4 lumbar, 5 sacral.

The single ganglion (ganglion impar) is located in front of the coccyx, and is the last of the chain; that is, as the two cords pass into the pelvis they converge and unite, ending in this ganglion.

Each ganglion may be regarded as a distinct center; it receives motor and sensory filaments from the cerebro-spinal nerves, contributes a communicating fiber to every cerebro-spinal nerve, communicates with other ganglia by means of intercommissural fibers, sends branches to the internal viscera. and helps to form plexuses of nerves which ramify upon the coats of all the blood-vessels, and which accompany them throughout the length of their course. Every sympathetic ganglion is a vasomotor center, though more or less dominated by the higher ganglia.

The *cranial ganglia* are located as follows: (1) The ophthalmic or ciliary ganglion is situated deeply in the orbit, and its filaments are distributed chiefly to the ciliary muscle and the iris. (2) The spheno-palatine, also known as Meckel's ganglion, is the largest of the cranial ganglia, and is situated in the spheno-maxillary fossa, near the spheno-palatine. Its branches are distributed chiefly to the gums, hard and soft palate, mucous membrane of the nose, and the middle auditory meatus. It also sends a branch to the carotid plexus. (3) The otic ganglion, or Arnold's ganglion, is situated just below the foramen ovale. Its filaments of distribution go to the mucous membrane of the tympanic cavity and Eustachian tube and to the tensor tympani and tensor palati muscles. It also sends a branch to the carotid plexus. (4) The submaxillary ganglion is situated above the deep portion of the submaxillary gland. It receives a branch from the chorda tympani, by which it communicates with the facial; it is also connected with the gustatory nerve of the fifth by a few filaments.

The three *cervical ganglia* are situated opposite the third. fifth, and seventh cervical vertebræ respectively. The principal nerves which arise from these ganglia are the three cardiac nerves, which pass to the heart and enter into the formation of the cardiac plexus. They also send branches to help form the carotid and cavernous plexus.

The *thoracic ganglia* (the 12 dorsal) are situated in the chest, beneath the pleura, and rest on the heads of the ribs. The upper thoracic ganglia send branches of distribution to

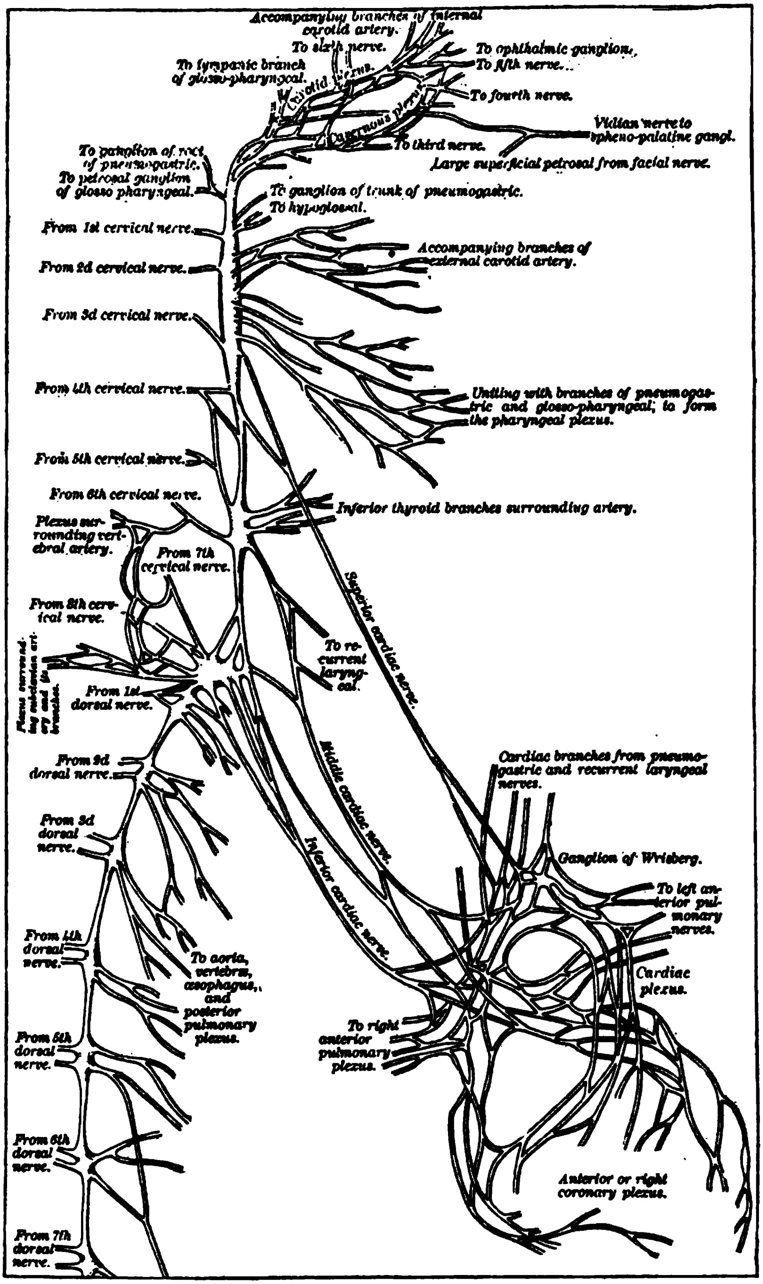
Accompanying branches of internal carotid artery.
To sixth nerve.
To ophthalmic ganglion.
To tympanic branch of glosso-pharyngeal.
Carotid plexus.
To fifth nerve.
To fourth nerve.
Cavernous plexus.
Vidian nerve to spheno-palatine gangl.
To third nerve.
Large superficial petrosal from facial nerve.
To ganglion of root of pneumogastric.
To petrosal ganglion of glosso pharyngeal.
To ganglion of trunk of pneumogastric.
To hypoglossal.
From 1st cervical nerve.
Accompanying branches of external carotid artery.
From 2d cervical nerve.
From 3d cervical nerve.
From 4th cervical nerve.
Uniting with branches of pneumogastric and glosso-pharyngeal; to form the pharyngeal plexus.
From 5th cervical nerve.
From 6th cervical nerve.
Inferior thyroid branches surrounding artery.
Plexus surrounding vertebral artery.
From 7th cervical nerve.
Superior cardiac nerve.
From 8th cervical nerve.
Plexus surrounding subclavian artery and its branches.
To recurrent laryngeal.
From 1st dorsal nerve.
Middle cardiac nerve.
From 2d dorsal nerve.
Cardiac branches from pneumogastric and recurrent laryngeal nerves.
From 3d dorsal nerve.
Inferior cardiac nerve.
Ganglion of Wrisberg.
To left anterior pulmonary nerves.
From 4th dorsal nerve.
To aorta, vertebræ, œsophagus, and posterior pulmonary plexus.
Cardiac plexus.
To right anterior pulmonary plexus.
From 5th dorsal nerve.
From 6th dorsal nerve.
Anterior or right coronary plexus.
From 7th dorsal nerve.

FIG. 88.—SHOWING THE DISTRIBUTION OF THE CERVICAL PORTION OF THE SYMPATHETIC. (After Flower.)

the aorta and its branches. From the third and fourth ganglia branches are given off which form the posterior pulmonary plexus. From the lower thoracic ganglia the three splanchnic nerves (the greater splanchnic, the lesser splanchnic, and the smallest or renal splanchnic nerve) are given off. The great splanchnic nerve arises mainly from the seventh, eighth, and ninth ganglia, receiving a few filaments from the upper six ganglia. These roots unite to form a large, round, white cord, which penetrates the diaphragm and terminates in the semilunar ganglion, sending a few filaments to the renal and suprarenal plexuses. The lesser splanchnic nerve is formed of filaments from the tenth and eleventh ganglia, passes through the diaphragm with the greater splanchnic, and joins the *cœliac* plexus. The renal splanchnic nerve arises from the last thoracic ganglion, and passes through the diaphragm, and terminates in the renal plexus and lower part of the cœliac plexus. The three splanchnic nerves present numerous anastomoses with each other.

The *lumbar ganglia* are situated in the lumbar region, upon the bodies of the vertebræ. Their branches of distribution assist in forming the aortic lumbar plexus and the hypogastric plexus, and follow the course of the blood-vessels.

The *sacral ganglia* are situated in front of the sacrum, along the inner side of the sacral foramina. Their filaments of distribution go to all the pelvic viscera and the blood-vessels.

The last of the ganglia, the *coccygeal ganglion*, or ganglion impar, as has been stated, is situated in front of the coccyx.

The *semilunar ganglia* (two in number), sometimes called the abdominal brain, are the largest ganglia in the body. They are situated in front of the crura of the diaphragm, near the suprarenal capsule. To the upper part of each ganglion the great splanchnic nerve (the most important sympathetic nerve in the body) of the corresponding side is attached. In addition to the semilunar ganglia receiving the great splanchnic nerve of both sides, they receive part of the lesser splanchnics and the termination of the right pneumogastric. From the

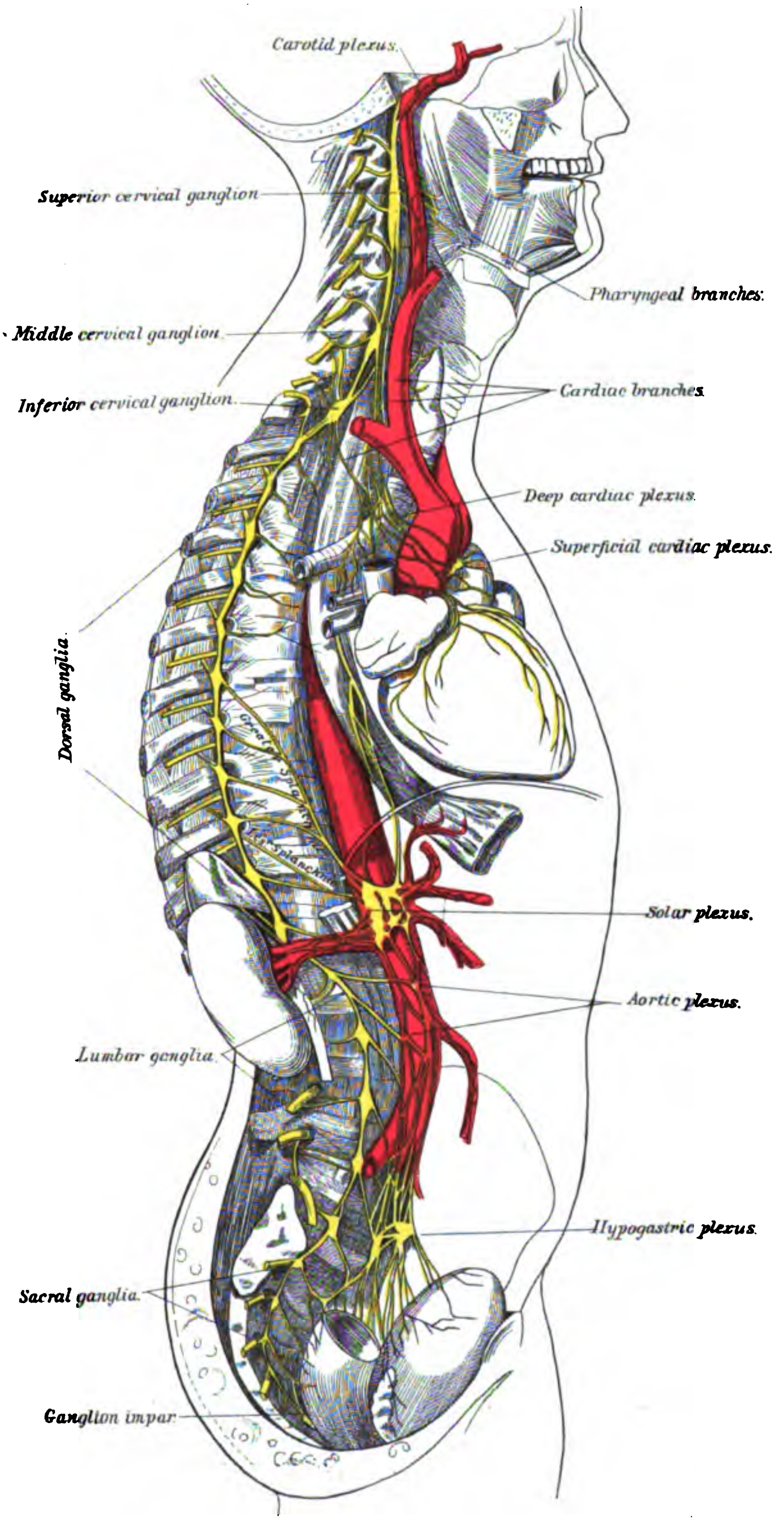

FIG. 89, PLATE XIX.—THE SYMPATHETIC NERVE. (After Gray.)

inner side of each, radiating branches are given off to assist in the formation of the solar plexus.

The great plexuses of the body are the *great* or *deep* cardiac plexus and the *superficial* cardiac plexus in the thoracic cavity, the *epigastric* or *solar* plexus in the abdominal cavity, and the *hypogastric* plexus in the pelvic cavity.

From each of these large plexuses branches are given off which form numerous smaller plexuses, which, in turn, distribute branches to every blood-vessel and to every organ in the body.

The great or deep cardiac plexus is situated in front of the trachia at its bifurcation. It is formed by the cardiac nerves derived from the cervical ganglia of the sympathetic and the recurrent laryngeal and pneumogastric. Its branches form the posterior coronary plexus, part of the anterior coronary plexus, while a few are distributed to the pulmonary plexus.

The superficial cardiac plexus lies beneath the arch of the aorta, in front of the right pulmonary artery. It is formed by the left superior cardiac nerve, the left inferior cervical cardiac branches of the pneumogastric, and filaments from the deep cardiac plexus.

It forms the chief part of the anterior coronary plexus; a few of its branches pass to the left anterior pulmonary plexus. These two plexuses are the chief supply of all the viscera of the thoracic cavity.

The epigastric or solar plexus is situated behind the stomach and in front of the aorta and crura of the diaphragm. It is formed chiefly by the branches given off from the semilunar ganglia. From its branches numerous plexuses are formed, taking the name of the organ to which they are distributed; for instance, the *phrenic* plexus supplies the diaphragm, the *renal* plexus the kidneys, etc.

The solar plexus, by means of the plexuses given off from it, supplies all the viscera in the abdominal cavity. The solar plexus, connected, as it is, with almost every organ of the body, with a vast influence on the circulation, with direct power over all the secretions of the abdominal and pelvic viscera, with a reflex reaction on the heart that under certain conditions may lead to fatal syncope,* may well be considered as the very center of life itself. This abdominal brain in a general way presides over nutrition, controls circulation and secretion, and governs the organs of generation.

The hypogastric plexus is situated in front of the promontory of the sacrum, between the two common iliac arteries. It is formed from the branches given off from the lumbar ganglia and filaments from the aortic plexus. This plexus passes downward and divides into two plexuses—namely, the pelvic plexuses.

Branches given off from the pelvic plexuses form numerous other plexuses, which take the name of the organ to which they are sent; for instance, the *vesical* plexus is distributed to the bladder, the *prostatic* plexus to the prostate gland, the *vaginal* plexus to the vagina, and the *uterine* plexus to the uterus.

The hypogastric plexus with its subdivisions supplies all the viscera of the pelvic cavity, and, on account of the frequency of disease of those parts, is one of the most important divisions of the sympathetic system.

The sympathetic nerve-fibers are of two kinds: (1) Communicating, by which the ganglia communicate with each other and with the cerebro-spinal nerves. By means of the communicating nerves the actions of the cerebro-spinal and sympathetic systems are brought into perfect accord. (2) Distributing, supplying in general all the internal viscera and the coats of the blood-vessels. It is by means of the distributing nerves (nerves derived from the gangliated cords and from the plexuses) that the sympathetic nerve is enabled to control the involuntary muscular fibers within the coats of the blood-vessels, and thus to regulate the blood supply of the various tissues and organs of the body.

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* A marked example of reflex inhibition of the solar plexus is shown when a blow in the region of the stomach causes the heart to stop.

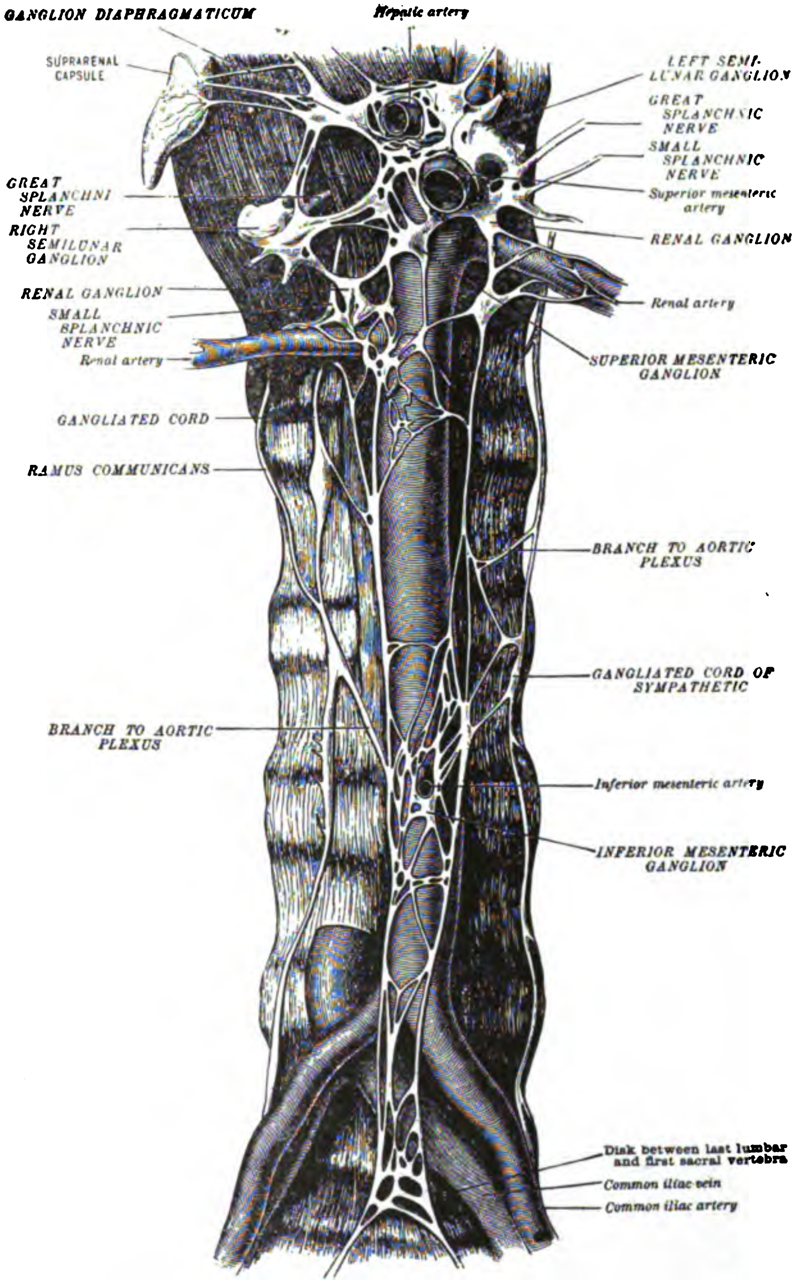

FIG. 90, PLATE XX.—LUMBAR PORTION OF THE GANGLIATED CORD, WITH THE SOLAR AND HYPOGASTRIC PLEXUSES.—(Morris, after Henle.)

These nerves are termed the vaso-motor nerves, and are divided into: (*a*) the vaso-dilator nerves; (*b*) vaso-constrictor nerves.

Dilator nerves are those nerve-fibers which under a stimulus produce enlargement of the blood-vessels and more active circulation.

Constrictor nerves are those nerves which under a stimulus produce contraction of the vessels, thereby lessening the caliber of the vessels, and thus diminishing the blood-supply to the parts which these nerves supply.

The circulation is influenced by these nerves nearly in the same way as the voluntary muscles are controlled by the cerebro-spinal nerves.

The nerve-fibers of the sympathetic are often called the "nerves of organic life," since they regulate the life of tissues by controlling their blood-supply; while the cerebro-spinal nerves are contra-distinguished as the "nerves of animal life," since they control those acts which are essential to the life of the individual.

The function of the sympathetic nervous system is to preside over and govern nutrition, secretion, and circulation; it is the source of all that automatic clockwork which, sleeping or waking, regardless of will-power or cerebral consequence, controls the vegetative functions of all animal life. The chief or prominent characteristics of its physiology are rhythm, or peristalsis, and reflex action.

The part which the sympathetic system plays in disease has been partially brought out when speaking of the various diseases of the cerebro-spinal nervous system, but will be better understood by a study of the propositions which follow later.

The sympathetic nervous system in its office, both in health and disease, has not been sufficiently studied and comprehended. Writers and lecturers on nervous diseases have been prone to place too much stress upon lesions of the cerebrospinal system, neglecting in whole or in part those relating to the sympathetic system. Diseases of the cerebro-spinal system are, in fact, largely functional or reflex in character, due to an irritation of some part of the sympathetic system. As Professor Pratt rightly says: "The result of this misapprehension of the relative importance of the two nervous systems in matters of nutrition, from a professional standpoint, has been to lead the medical profession into a hare-and-hound chase after the effects of disorder, rather than point them to their cause."

In the light of recent developments in regard to the reflexes, no other measure affords so much relief for nervous troubles as does the judicious application of the "orificial philosophy." *Orificial philosophy in reality is the study of the sympathetic nervous system—its relations and its diseases, and the best measures to be used for the cure.*

Orificial philosophy especially emphasizes two points: (*a*) the importance of healthy openings of the body, especially their power when diseased to influence nutrition; (*b*) the great changes caused by reflexes through the sympathetic nerve.

A thorough understanding of the new light now being thrown on the subject of reflexes will make many diagnoses an easy matter that before seemed beyond accomplishment. Troubles that were once hard to account for, and still harder to cure,—such as neuralgia, nocturnal erotic dreams, despondency, melancholia, irritable bladder, loss of appetite, cough, asthma, sexual weakness, headache, dyspepsia, cold hands and feet, irregular action of the heart, etc., will now yield to treatment predicated on a correct diagnosis.

No physician should remain ignorant or indifferent to the great flood of light which orificial philosophy has shed upon the treatment of not only reflex nervous troubles, but also all forms of chronic diseases.

Orificial philosophy does not conflict with any other measure for giving relief. It does not deny the truths of the "Organon," nor the law of *similia*, but it supplements when the organism fails to respond. It paves the way for the potentized drug. Remedies whose action before seemed to be inert now respond with brilliant results.

Such being the fact, it is a method of cure which no progressive medical man can afford to ignore. Its philosophy opens up a large field of study unappreciated by all save those who have earnestly engaged in it.

Orificial philosophy is not a " fad " of to-day, to be passed by to-morrow and relegated to the shelf, but it is simply the intelligent application of mechanical measures to produce the same effects we are all of us constantly striving to gain by the use of drugs—viz., the restoration of the capillary circulation to its normal equilibrium.

Orificial philosophy, like any other great truth, is bound to win its way to complete and universal recognition. It has gathered strength day by day, not on account of its theory, but from the most practical of all witnesses, its results. It is the results by which we are enabled to judge of the truth or falsity of a system, and this has stood the test.

Orificial philosophy is based upon the theory of reflexes. No treatment of the past, medical or surgical, employed for the relief of nervous and chronic diseases, gives such universal satisfaction as the system of " orificial philosophy."

In formulating the propositions which follow, I have culled freely not only from articles (also sayings) of Professor E. H. Pratt, the " father " of orificial philosophy, but also from the articles written by various other writers upon this specialty. The following are the main *truths* embraced within the system of orificial philosophy, and the basis for all *orificial treatment;* also, as has been stated, a reference to these propositions is the best method of studying the functions and pathology of the *sympathetic nervous system.*

Although anatomists have for many generations called attention to the existence of the sympathetic nerve and its functions, and recognized theoretically the important part which it plays in the nutrition and rebuilding of every part of the bodily structure, nevertheless, in the maintenance of health and the healing of the sick it has been practically ignored until *orificial philosophy* was established.

All bodily functions are presided over by the great nerve of animal life—the sympathetic.

The sympathetic nerve is the great nerve of animal existence; on its tonicity and uninterrupted action depends those functions which are essential to maintain life.

By day and by night, in rest and in toil, under all conditions and at all times, without the aid of the cerebro-spinal system, the sympathetic force is still maintaining the functions of animal life.

The mission of the sympathetic nervous system is to regulate the heart's action, induce respiration, promote gastric peristalsis and peptic secretions, and, aided by the cerebro-spinal system, it operates with clock-like precision the capillary circulation and glandular secretions, and controls muciparous secretions and also the aggregate functions of the reproductive apparatus.

The great sympathetic furnishes the nerve-energy necessary to maintain the body in the equilibrium of health, and if this equilibrium is disturbed at any point, in a short time other organs that are in sympathy with the first one affected will also become involved; and they will operate to extend the general disturbance until every organ and tissue is more or less affected.

The sympathetic nerve holds in close bond of union all the structures which it supplies.

Circulation, nutrition, secretion, and excretion—*i. e.*, the whole vegetative life of the body—are dependent upon the even, undisturbed action of the vital, automatic, or sympathetic system of nerves.

Every human being depends for life and action upon that imponderable, intangible power called vital or nerve force; all bodily functions and physical maneuvers are operated only because of the inspiration imparted to them through this force.

Sympathetic force is the steam which propels the entire enginery of the body. When it is abundant, peristalses are vigorous, capillary circulation is normal, and health prevails throughout the various tissues. When it is deficient, peristalses become sluggish, effete material is unduly retained, fresh material is insufficiently supplied, capillary circulation is irregular and inadequate to the renewal and purification of the tissues, blood stasis results in whatever part of the body is used most or is weakest by nature, and pathology finds its incipiency.

While each organ of the body has its separate functions to perform, and while it possesses its own peculiar characteristics personal to itself, it is at the same time a part of the whole body, partaking of its weakness and of its strength, its sickness and its health, its joys and its sorrows, its poverty and its prosperity, its virtues and its vices, its integrity and its disintegration.

A disordered function in one part can disarrange and disturb, to a greater or less extent, the harmonious action of any or all other parts.

All the pelvic organs are held in close relationship by the sympathetic system in such a manner that any one of the organs may suffer metastatically.

Excessive or deficient function of the abdominal and pelvic organs depends on the solar plexus and its peripheral organs.

All the abdominal plexuses, with their extensive automatic peripheral ganglia, seem to have their center of origin in the solar plexus.

Abdominal irritation from any of the peripheral plexuses, and from whatever cause, reaching the solar plexus, disturbs normal vasomotor action, and creates malnutrition in the digestive tract, where its peripheral nerves are very prominent, with disastrous consequences—impairment of the whole visceral economy.

Peripheral nutrition, normal circulation, and vascular tone can only be maintained by the undisturbed rhythmical action and flow of the sympathetic nerve-force; this cannot exist when any part or branch of this sensitive tissue is suffering through compression or friction and its forces being misdirected or run to waste.

We may be unconscious from normal slumber, from injury, or from anæsthesia, and yet our sympathetic watches over and keeps our hearts pumping, our lungs contracting and expanding, and keeps going all the other necessary actions of life.

The life of the body is the sympathetic nerve, and according to its integrity is the physical power of the body.

Diseases are produced only by the morbidly disturbed vital force.

Reactive power, vitality, good capillary circulation, and sympathetic power are synonymous terms.

Capillary circulation is the basis of all blood activity.

A normal circulation of the blood in all the arteries and veins, especially of the capillaries, is indispensable to good health.

Health cannot be maintained without the support of a vigorous capillary circulation.

Only when there is a vascular atony, enfeebled circulation, or malnutrition, can disease find a place, whether in the individual, the organ, or the tissue.

All nutrition depends upon capillary circulation, and all activities of the body upon peristaltic action, and these are controlled by the sympathetic nerve, and the waste and repair of the sympathetic nerve-power is the all-important question in the healing of the sick.

If the blood-current is strong and free, health is assured; if, on the other hand, the general circulation is sluggish, or local congestions occur, morbid processes are of a necessity initiated.

To re-establish and to maintain a normal circulation, local and general, is, therefore, the great problem that demands solution in the successful treatment of chronic diseases, both medical and surgical.

The strength of the body is dependent upon the tonicity of the sympathetic nervous system, and whatever weakens this system of nerves makes the body less powerful to ward off disease.

As is the condition of the sympathetic nervous system, so will be the condition of every organ in the body, and of its function, and of the cerebro-spinal nervous system.

When the sympathetic nerve force is abundant, all peristaltic actions are vigorous, and all bodily activities are well accomplished.

The condition of the sympathetic nerve power has more to do with the health and happiness of the human body than has been supposed.

The problem of health is the problem of sympathetic nerve-force.

The problem of disease is the problem of sympathetic nerve-waste.

A vigorous sympathetic nervous system means health and long life.

Upon the integrity of the sympathetic nerve depends the tonicity and nutrition of the entire body, even the cerebro-spinal nervous system itself.

The body is made up of tubes, and these tubes are presided over and controlled by the sympathetic nerve.

The sympathetic nerve is the sole stimulant of all the involuntary muscles.

Prolonged muscular contraction of the involuntary muscular fibers involves a prodigal waste of nerve-force. The point where this usually occurs is at the lower opening of the body.

The fact that sympathetic nerve-waste can go on painlessly from abnormal contractions of the muscular fibers kept up by a very slight form of irritation, needs more careful consideration than it has hitherto received.

Sympathetic nerve-waste is the predisposing cause of chronic disease.

The key to the cure of chronic diseases is the re-establishment of the sympathetic nerve-power.

Therefore, there is one predisposing cause of all chronic diseases, and that is a sympathetic nerve-waste occasioned by orificial irritation at the lower openings of the body.

Health therefore demands a vigorous sympathetic nerve; in other words, the continuation of any disease implies a continuous waste of sympathetic power.

An overdraft of nerve-force going on from day to day results in lowered vitality, which affects the general health.

A waste of sympathetic nerve-force is the predisposing cause of weakened peristaltic action.

All bodily processes are accomplished by peristaltic action, furnished by involuntary muscular fibers.

Weakened peristaltic action is the beginning of congestion.

The normal circulation of all solids, liquids, and gases of the body, being dependent upon peristaltic action, therefore relies upon the sympathetic nerve-force for its activity.

Weakened tubular action is the first step of functional derangements, and consequently the first step of organic lesions, and this is rendered possible only by weakened sympathetic nerve-force.

All the visceral organs, the circulatory and secretory organs and vessels, the whole nutritive process, are governed and controlled, not by the will-power of the intelligence, but by the sympathetic nervous system.

Derangements of the secretory and excretory organs, whether of the liver, the kidneys, or the lymphatic or other glandular structures, which are all dependent on the automatic nerve-supply, are evidences of nerve-waste, of orificial irritation.

The circulation of blood is under control of the vasomotor system of nerves.

The vasomotor nerves are the intermingling of the terminal nerve-fibers of the sympathetic and the cerebro-spinal systems.

Either nervous system can therefore influence the circulation, and consequently the nutrition; but it is the sympathetic upon which the vasomotor system mainly depends, as the sympathetic never sleeps.

The cerebro-spinal system, under an anæsthetic, in sleep or in an abstract state, leaves to the sympathetic nerves the duty of furnishing a proper supply of nerve-force to the vasomotor system.

The sympathetic nerve alone is steady and tireless in its action and the mainstay of circulation.

While there is no semblance of divorce or separation between the cerebro-spinal and the sympathetic, inasmuch as both have to do with the same life, and have to some extent complemental relations, the fact remains that they speak individual languages and require individual interpretations.

We are warned of and directed to irritation of the cerebro-spinal nerve by special pain; but the sympathetic may be strongly irritated and we know nothing of its presence, unless it be by symptoms of disturbed nerve-force or disturbed nutrition; or, in other words, the pinching of a cerebro-spinal nerve involves pain—of a sympathetic nerve, functional disturbance.

While the cerebro-spinal nervous system serves the purpose and obeys the orders of the tenant of the body, having charge over all voluntary and grossly sentient exhibitions of life, the sympathetic rules in all that sphere which is beyond the intellect. It has sole charge of all those processes that pertain to the vegetable or creative functions of life, and that go on without will-power or mind-intervention.

The great sympathetic nervous system presides over the functions of all the organs of nutrition; but the mind through the brain imposes the kind and amount of work on the sympathetic nervous system that it performs, and in the exact ratio that the sympathetic nervous system has been abused will the effect be reflected to and react upon the spinal nervous system, brain, and mind.

The action of the cerebro-spinal system is spasmodic, and not to be relied upon for the process of nutrition; it goes to sleep every night.

The sympathetic nerve is tireless in its activity; it sleeps but once, and that sleep is final.

The sympathetic nervous system seems to act as a balance-wheel to the rest of the nervous architecture.

You may take away from a part its nerve-supply, so far as sensation and motion are concerned, yet it will live; but let the ganglionic or sympathetic nerve-supply be destroyed also, and you will straightway see molecular death follow as an inevitable result.

The primary cause of pathology is congestion due to sympathetic nerve-waste.

Congestion excites, inflammation irritates, infiltration compresses, and cicatricial tissue binds.

The cervical ganglia of the sympathetic nerve communicate directly with the phrenic nerve, and through the solar plexus and cardiac plexus with the pneumogastric nerve so that the heart, lungs, and larynx, as well as the diaphragm, are invariably affected in a secondary manner by undue nerve-exhaustion of the sympathetic.

Should the sympathetic nerve-centers become involved by metastatic irritation, and the mischief be transferred by other nerves issuing from them to the stomach, lungs, heart, brain, spinal cord, or other remote organs, the congestion will also be transferred, and the signs of local mischief will disappear to a remarkable extent.

It is a well-established fact that local irritations are capable of creating pathological disturbances in distant organs.

The ganglia of the sympathetic nerve, situated in front of the spinal cord, are miniature brains, and they receive pleasures and punishments and cause muscles and glands to act well under favorable auspices and faulty under opposing conditions.

The nerve-cells of the ganglia are profoundly affected by continued irritation of their ingrowing peripheral nerves.

Subjective symptoms and disturbances of the ganglionic or sympathetic nervous system are often overlooked, and attention given to objective phenomena that are apparent upon the surface.

The constant expenditure of nerve-force so impairs the vigor of the constitution as to invite disease.

Whatever causes a waste of sympathetic nervous power lowers the nervous tone of the entire sympathetic system.

The study of orificial philosophy and its application to the cure of nervous and chronic diseases is the study of reflexes.

The term "reflex" may properly be applied to any generation of nerve-force which occurs as a consequence of an impression received by a nerve-center.

Reflex sensations: Those symptoms in which the irritation is made at one point and felt at another. The whole class of so-called reflex pains are really transferred sensations, since in reality there is no reflex action in the process.

The law of reflexes is that a disturbance of any part of the sympathetic nerve disturbs, to a greater or less degree, the whole system.

By "reflex pathology" is meant a pathological condition which has for its origin some particular irritation affecting the sympathetic nerve or tissue supplied by it, either near to or remote from the local manifestation.

The reflex process is always ascending.

The human body is a bundle of reflex action, and reflex irritation is a cause of many nervous disorders, which must be treated accordingly.

Impressions evolved from one set of nerves may pass on through ganglia and brain to reappear as reflex phenomena in organs and structures furnished by another set of nerves entirely.

Irritation may be direct or reflex; it may be transient or continuous. When transient, the organ may sustain its function; but when continuous, it must become irregular in motion, nutrition, and secretion, and abnormal in function.

Irritation is caused by abuse of function or faculty.

An irritable lining membrane is the cause of spasmodic action of involuntary muscles.

The seat of congestion need not be at the point of irritation, but will always be located at the point of least resistance.

The irritation of an organ starts at its mouth, and when we remove this irritation, the result will be to relieve the sympathetic nerve-waste, and thus to correct the whole morbid manifestation.

An irritation applied to one part of the sympathetic nervous system may set up disorders in a remote part from the point of irritation.

Wherever there is a reflex irritation there is also reflex congestion.

The irritation is reflected through the sympathetic and vasomotor systems to other organs, producing in them a condition similar to that which primarily existed at the seat of irritation; for example, a patient having some form of uterine irritation or congestion often ceases to be conscious of any local disturbance whatever, but suffers intensely from cerebral, spinal, or other distress remote from the cause of the pain, the congestion following the line of irritation.

It has been demonstrated that the manifestation of the sympathetic nerve-irritation will be at the point of least resistance or in the weakest organ, regardless of the point of irritation; hence the failure of treatment which is directed to the organ manifesting functional disturbance when the pathology which causes it is elsewhere and unaffected by the treatment.

A patient may suffer from severe irritation of the stomach and yet the cause be reflex, the prime cause being an irritable sphincter or other irritation at the openings of the body, reflecting upon the stomach.

An irritation at one point may refer the painful sensation to a distant part from which the irritation has sprung, and finally appear to have its origin in that part, while the original seat of the mischief is lost sight of altogether.

An irritation at one point may be reflexed upon the system at large, and as a result of this reflex action the system may become deplete on account of the inability of the organs to properly perform their functions, which prevents the assimilation of food, and thus deprives the patient of proper nourishment, which eventually results in nervous prostration.

The most important physiological characteristic of the sympathetic system is reflex action—and stimulation or irritation of any part or point may not cause any manifest effect at that particular point, but is conveyed to the center or ganglia, and it is thence reflected out to other more or less distant parts with which it is connected.

The study of reflex irritation is exceedingly interesting as well as profitable, for by the symptoms it produces we are often led to the real cause of the condition.

The law of reflex causes in disease is no longer questionable, and it is a fact that many an individual wastes the whole of his force in this way.

Functional derangement is the first cause of organic affections.

Many of the so called functional disorders are due to organic disease, and it is not always where the symptoms of disease are found that the organic trouble is located.

A functional trouble may survive the cause or the organic lesion which gave it birth; a child who has been susceptible to convulsions repeats these convulsions under the slightest provocations; certain pains last when the lesion which is the cause of them no longer exists.

Disease is reversed function, or function abnormally performed.

Congestion is the beginning of disease, and is caused by irritation of terminal nerve-fibers, and terminal nerve-fibers supply every organ and viscera in the organization, and they are the most profusely supplied to terminal organs, orifices, and organs which perform the most important functions in the organic economy; hence the greater sensitiveness of these organs and orifices, and, when diseased, the more powerful the reflexed influence on other organs, and finally upon the brain and mind.

Abuse of an orifice or of an organ unnaturally irritates its terminal nerve-fibers, and this irritation is reflexed to the ganglion which controls the function of that orifice or organ; and in the ratio of abuse will irritation increase and hyperæmia and reflex processes obtain.

Functional derangements of vital processes throughout the body are manifestations of a disturbed, irregular action of sympathetic nerves, and this is nowhere more manifestly true than in the circulatory system.

Continued irritation of terminal nerve-filaments leads to functional disturbance of that or remote parts, or both; this continued functional derangement leads, sooner or later, to structural change, which means *organic* disease.

The parts most likely to be injured or irritated are those which are exposed to external influences, the constriction of sphincter muscles, or the bruising and compression attending the expulsion of the contents of the womb, rectum, or bladder.

The greater the irritation of the terminal fibers of the sympathetic and spinal nervous systems the weaker will be these two systems of nerves and less mental concentration will be necessary to derange the mind and develop insanity.

The weakness and the power of the sympathetic nerve lies at the orifices of the body.

From their anatomical distribution the sympathetic nerves are to be found or reached only through the orifices or openings of the body.

The central thought in orificial philosophy is to avoid undue impingement of nerve-fibers, whether in a normal or abnormal condition; this great principle finds its application not only in treating the sphincter-guarded openings of the body, but wherever wounds are closed or stumps are treated.

If nerves are pinched and become dormant they cannot involve wholesome stimuli, and medicine can exert but little action on the parts they are deputized to govern and operate.

To choke a nerve-filament is to impair its power to transmit human electromotive force.

Prolonged, unremitting contractions of any involuntary muscle not only wearies the muscle, but tires the whole sympathetic nerve, thereby undermining the vigor of every peristaltic action in the body, and laying the foundation for disordered functions and passive congestions which are the beginning of all pathology.

Prolonged muscular action of either voluntary or involuntary muscular fibers involves a prodigal waste of nerve-force.

Spasmodic actions of involuntary muscles are the cause of weakened nerve-force.

A functional trouble which was originally secondary to some other pre-existing affection may in time become itself independent and continue to exist after the trouble which was at first the exciting cause has been removed.

Local congestions and functional troubles may become chronic and organic if allowed to continue.

Chronic local lesions are but physical expressions which tell of a greater or less depression of general vitality.

The amount of local trouble present furnishes no index to the nerve-waste involved, or to the necessity for the work, or the beneficial effects to be expected from it.

Many times we find that severe local lesions sufficiently irritable to make the patient conscious of their presence are not accompanied by reflex irritation, as are others less severe in their local manifestations, and as soon as they are corrected, that patient is perfectly well. But in lesions where the patient is unconscious of local disturbances, and often no symptoms can be elicited of local irritation, upon thorough examination we find a previous condition of irritation and congestion of these parts which has been transferred from them to other parts by metastasis.

The patient's sensations are not a safe guide to the existence of irritations at the orifices of the body.

All the lower orifices are guarded by sphincter muscles more or less supplied by the sympathetic nerve.

The sphincter muscles are more richly supplied with nerves than any other in the human body. This is notably true of the sphincter ani.

Each one of the lower openings of the body (rectum, urethra) is guarded by two distinct sphincter muscles, an upper and a lower.

The upper one is composed of involuntary muscular fibers, and is supplied by the sympathetic nervous system.

The lower sphincter is made up of voluntary muscular fibers, and is under the control of the cerebro-spinal nervous system.

Clinical experience has proved that if all irritating conditions of the lower orifices of the body were corrected, many chronic ailments of other parts of the organism were thereby cured or rendered amenable to the curative properties of means previously indicated but inefficient.

Dilatation of the sphincters supplied by the sympathetic nerve has the remarkable effect of instantly equalizing the capillary circulation of the entire body, flushing parts that are anæmic, relieving parts that are congested, and arousing the entire system to renewed activity.

Any stimulation or irritation of the sympathetic nerve-centers, by dilatation of the sphincters or otherwise, will produce an immediate flushing of the superficial blood-vessels and capillaries and an equalization of blood-pressure, while a pathological condition interfering with the action of these nerves and causing, as it always does, more or less waste of this vital force. results in disturbed circulation and impaired nutrition.

In the ratio of the severity and duration of irritation or hyperæmia of these orifices and terminal organs will pathological processes and influences be reflexed to other ganglia, spreading from organ to organ, onward and upward to the great nerve-center of the entire organization—the brain.

Persistent spasmodic contraction of the sphincters inevitably induces abridged peristalsis in all the tubular departments of the body.

If all the orifices of the body are in a perfectly normal condition no malnutrition can exist.

The sphincter ani is the most perfect type of sphincters, and, in keeping with its great importance from the standpoint of function, it is more richly provided with nerves than any of its class, or, in fact, than any other muscle in the body.

The nerve-supply of the sphincter ani is from two sources, the sympathetic and the cerebro-spinal, and this seems to be the chief and most noteworthy point of peripheral communication between these two systems.

When at rest the sphincter ani is in a state of tonic contraction, and is conspicuous among muscles as being the only one which requires the constant expenditure of nerve-force to maintain it in its normal inactive condition.

The intimate connection which is maintained between the vital centers of the lower portion of the rectum and its sphincters, through their extensive nerve-supply, is demonstrated at every operation upon these parts.

A tightly contracted irritable sphincter may cause a great variety of reflex symptoms.

Just so sure as there is a morbid pile-bearing inch, just so sure will trouble be reflected, sooner or later, to some organ or function connected therewith through the spinal cord or ganglia.

The constant waste of sympathetic nerve-force caused by a morbid state of the rectum destroys the reactive power of the system to such an extent as to entirely prevent improvement in any disease from which a patient is suffering until that source of nerve-exhaustion is removed.

Rectal diseases are the foundation and cause of many grave forms of chronic and nervous diseases, which it is impossible to cure so long as the rectal lesion continues.

The condition of the rectum influences waste and repair more than any other one point of the system, and no chronic case is thoroughly examined without a rectal exploration.

Lesions of the rectum, when located posteriorly, are more apt to cause spinal disorders; when located laterally, they affect more especially the lower extremities; while those located in front, being directly under the prostate, exercise a greater influence upon the prostatic and urethral troubles.

The idea that rectal pathology influences the general health to a greater extent than a similar degree of pathology elsewhere in the body is one of the fundamental propositions of orificial philosophy.

It is difficult, too, to convince patients who are not much distressed locally that orificial means may improve their nutrition and flush their capillaries, stop their palpitation, and arrest their "sinking spells," allay their nervousness and strengthen their memories, make them more cheerful and dissipate that "tired feeling," render more supple their rigid muscles and reduce their swollen joints.

Experience has taught us that by anal dilatation you can shock the sympathetic more than by any other means yet known, as shown by the respiration induced by it in chloroform narcosis and asphyxia neonatorum.

Anal dilatation flushes the capillaries of the body universally, thus immediately equalizing the circulation, thereby relieving local congestion wherever it may be located, whether in the brain, liver, kidneys, stomach, or elsewhere.

In consequence of this increased capillary action, nutrition of the body in whole and in part is immediately improved and its reactive power increased, and if there are not too many organic changes, perfect health will be restored; or, if not quite restored, the properly prescribed remedies will be much more effective.

The most important truth which orificial philosophy has presented to the world is that anal dilatation flushes the capillaries and has a tendency to readjust the inharmonious action of the diseased body, whatever form its deviation from the standard may take.

Anal dilatation affects more profoundly the respiratory (and consequently the capillary) circulation than that of any other of the lower openings of the body.

Dilatation of the internal sphincter ani is the greatest resuscitator from chloroform narcosis on earth, and is especially applicable to asphyxia of the newborn babe.

The bivalve dispenses altogether with the use of nitrite of amyl, electricity, artificial respiration, inversion, etc., and is reliable.

If dilatation of the sphincter ani fails to set the wheels of life in motion again, other means of resuscitation (excepting urethral dilatation) constitute merely a forlorn hope.

Rectal dilatation is valuable in morphine, opium, and cocaine poisoning and for drunkenness.

Often where rectal dilatation has failed to produce an effect upon the respiration during the administration of an anæsthetic, the passing of a sound into the urethra produces the effect which the rectal dilatation fails to accomplish.

There is no danger in the employment of an anæsthetic in persons of weak lungs or heart disease in orificial work, for the act of dilating the sphincter is such that it at once removes the congestion of the lungs that would otherwise be occasioned and steadies the heart's action, thus rendering the administration of an anæsthetic safe when under other circumstances it might be dangerous.

However profound the anæsthesia, dilatation of the sphincter ani invariably produces stertorous respiration, profound modification of the heart's action, immediate congestion of the cutaneous capillaries, and muscular contraction and rigidity, sometimes amounting to opisthotonos.

Never allow the anæsthetic to be given during the act of dilatation.

Nothing can be so prone to produce fatal syncope as the commencement of the operation before complete anæsthesia has been induced, for then you have a lowering of the vital functions caused by the anæsthetic and the shock of cutting sensitive tissue before the conduction of the sensory nerves is in abeyance.

No remedy, medical, surgical, or psychological, is equal to the bivalve speculum.

Dilatation of the sphincter ani will often remove pain and distress from the stomach and arrest nausea and vomiting; it will arrest labored breathing and quiet a restless nervous system.

A thorough dilatation of the sphincter muscles when a rectal abscess is opened will prevent the heretofore inevitable fistula.

Small fissures and pruritus ani can be cured by keeping the parts absolutely dry and clean with cotton and an application of boracic acid, and overcoming the abnormal tension of the muscles by moderate dilatation with the small speculum.

Post-operative dilatation of the rectum is the most important of all the measures in aftertreatment, and should never be neglected.

There is a peculiar proneness to the formation of fibrous bands of contracting tissue in the rectum after the American operation, and this can be best overcome or prevented by the judicious but not meddlesome or excessive use of the rectal plugs. It should be commenced as soon as healing has taken place, and continued for several weeks or months, as may be necessary.

In using the bivalve you must dilate slowly and intermittently, allowing ample time for the parts to stretch instead of tearing.

No danger need be apprehended in the employment of the bivalve (if the dilatation is gradual), even when it is employed to its full capacity; it will not rupture the sphincter muscle or induce incontinence of fæces.

However, one steady grip on the handles would force the blades of the speculum apart so suddenly as to give the tissues no opportunity for relaxation and would occasion undue laceration and bruising of the parts.

Many times dilatation is needed beyond the capacity of the rectal bivalves, and the two first fingers of the two hands, introduced back to back, will be found necessary to secure a proper degree of dilatation.

The sphincters should not be stretched to the point of giving way of their fibers, but just short of it.

Without exception, the tight sphincter is an index of trouble in the pile-bearing inch of the rectum.

In a rectum too sensitive to stand examination without an anæsthetic you will always find the seat of morbid structural changes.

If the trouble is in the bowel the sphincters will usually be found to be abnormally constricted, and may be dilated either by the bivalve or rectal plugs.

No pathology causes more symptoms than hemorrhoids.

The location of even a small hemorrhoid, or an apparently insignificant pocket, or a papilla of any size, directly under the prostate, especially when accompanied by spasmodic tension of the internal sphincter, is sufficient excuse for the protraction of gleet, for the habit of lust, or the existence and obstinacy of seminal losses.

Pockets and papillæ are found more frequently in connection with lung troubles (especially consumption) than in any other variety of chronic disease.

Orificial treatment will prove beneficial in those cases where there is a reflex disease, such as dyspepsia, sick headache, asthma, nervousness, neuralgia, rheumatism, etc., caused by rectal irritation.

The base of the brain and rectal irritation are very closely associated.

Some form of rectal or sexual irritation is the basis of all cases of perversion of sexual instinct.

Both the rectum and sexual system will have to be put in a healthy condition before trouble in one of them can be cured.

The thorough eradication of disease in one outlet alone will give but partial or temporary relief to resulting nervous derangements, unless each and all affected parts are relieved of pathological conditions; thoroughness and completeness in this work are absolutely essential to success.

The rectum and sexual organs are so closely associated in the male as to make it imperative, in the cure of urethral troubles, to see to it that the rectum is in a normal state.

The sexual organs and rectum are central telephones, and run lines of communication to the top of the head, the soles of the feet, and to every square inch of bodily tissue between these extremes; these facts can no longer be ignored with impunity.

The man who presumes to a knowledge of genito-urinary troubles in the male and ignores the rectum is not properly equipped for his work.

Work upon the sexual system is sometimes ineffective and sometimes harmful, if rectal irritation is present and allowed to continue uncorrected.

It is just as essential to correct the sexual condition to effect a cure of the rectum as it is to cure the rectum to correct the sexual pathology.

The sympathetic nervous system supplies the entire sexual apparatus of either sex.

The reproductive center is one of the great (if not the greatest) points of irritation in the whole body, especially if there be a neurasthenic predisposition.

Any habit of life that impairs the organs of nutrition and of generation lowers the tone of the spinal and sympathetic nervous systems, diminishes the quantity and impoverishes the quality of nervo-vital fluid secreted by the cranial and ganglionic brains controlling the electric forces of the nervous systems, impairs the function of every organ of body and brain, weakens electric force, reverses magnetic polarity of system and organ, and impairs in an exact ratio the different faculties of the mind.

Upon the re-establishment of sexual vigor often depends the re-establishment of general health.

What lacerations of the cervix and perineum and congestion and displacement of the uterus and ovaries are to many female nervous symptoms, such are phimosis, redundant prepuce, varicocele, irritable testes, urethral contractions, and, above *all* and pre-eminently, irritations and congestions of the prostate and prostatic urethra with spermatorrhea to many male nervous symptoms.

If there are irritations found in the male generative organs, free the foreskin of all adhesions and smegma, cut the frenum, etc.

The most frequent and most important sexual abnormality in the male sex is exhibited in the conformation of the foreskin.

A foreskin which completely covers the glans penis while in a relaxed state of the organ is too long; one which compresses it snugly upon retraction is too tight; one that depresses the penis upon retraction has too short a frenum.

The most common deformity is where the foreskin is too long, or, in other words, redundant.

In male children a tight foreskin often creates sufficient irritation of the sexual organs to induce spasm or paralysis of the lower limbs by an indirect effect upon the spinal cord.

Many cases of hip-joint disease are influenced by the condition of the foreskin or clitoris, according to sex.

A contracted meatus may set up an irritation of the prostate gland, bladder, or kidneys.

The urethra is often sympathetically affected by disease of the rectum, and whenever symptoms in the urethra cannot be accounted for, after an examination of that part, the condition of the rectum should be carefully investigated.

Urethral dilatation with cold steel sounds, practiced weekly, will soon restore to its proper tone the sexual system, and is especially useful in nocturnal emissions.

Dilatation of the cervix uteri and male urethra relieves the pain and distress in the base of the brain, and removes gloom and despondency from the mind.

The prostatic inch of the urethra is one of the most important of the reflex centers in the body; morbid states located here cause nervous exhaustion, and but few cases of neurasthenia in the male are without this irritation.

Morbid conditions of the prostate glands may induce dyspepsia, lung and heart trouble, loss of memory, and periodical headaches in the male, just as uterine trouble can in the female.

If you wish to reduce an enlarged prostate, pass sounds. Their tonic action, by touching the orifices of the prostatic ducts, will invigorate and reduce to healthy condition the entire gland.

In the employment of sounds it is better to use them heated in irritable, hyperæsthetic, and spasmodic conditions of the prostate and urethra, whereas cold sounds are better in cases requiring tonic measures.

It is the condition of the prostatic inch that prescribes the condition of the testicles, and it is the condition of the foreskin, the meatus, the frenum, and rectum that prescribes the condition of the prostate.

There is a very close nervous connection between the sigmoid flexure of the colon and the prostatic inch, and many cases of prostatic trouble defy cure simply because of an irritable condition of the sigmoid flexure of the colon, which has been overlooked and is an active agent in sustaining the prostatic irritation.

On account of the nerve exhaustion which prostatic difficulties accomplish, they are prone to be one of the primary causes of all forms of chronic disorder, skin troubles, mucous membrane troubles, head, thoracic, and abdominal difficulties—in fact, the entire list of chronic diseases may find at least a part of their explanation in nerve-waste incurred by prostatic illness, which has been going on continuously until it has exhausted the reactive power of the body, but so silently as to escape the attention of both patient and doctor.

Urethral, prostatic, and bladder troubles are the precursors of kidney affections of various kinds.

A constant pain on top of the head is indicative of some morbid condition of the prostate or its analogue, the womb.

The prostate gland in the male corresponds to the uterus in the female, and is supplied by the corresponding pencil of sympathetic nerve-fibers. Therefore, when in a pathological state, it is capable of instituting all the reflex disturbances and symptoms in the male which the uterine pathology can induce in the female.

In the male, the point of the penis and the prostate are the centers of the sexual system; in the female, the internal os, the urethra, and the clitoris are the centers of the sexual system.

The prostate gland in the male (or its analogue, the uterus, in the female) is the central office of pelvic anatomy, and as such is more prone to metastatic irritation than any of the other pelvic organs.

Never undertake to treat a case of uterine disease without first treating the rectal conditions.

So intimate is the relation between the rectum and uterus that if one is diseased the other cannot carry on its function with success.

In many cases it will be found that if the rectum is radically cured the uterine troubles will cease.

One of the chief causes of habitual miscarriages is rectal disease of some sort.

The *internal os* is the last gateway to the chamber which has cradled the race; it is where the neck joins the body of the organ; it is the point at which all flexions take place; it is the great blood, lymphatic, and nerve center of the female sexual apparatus. Its condition of tension or relaxation, of health or disease, influences the entire female sexual tonicity, and through this the general bodily welfare.

Irritation of the internal os uteri may induce bowel and stomach complaints, kidney and liver disorders, lung and heart irregularities, brain and spinal affections, and all kinds of circulatory and nervous troubles.

Nearly all menstrual headaches may be relieved by dilatation of the internal os.

Lesions of the internal os are especially liable to be followed by reflex disturbances.

Uterine pathology is, more than any other source of irritation, the common cause of ovarian and tubal troubles.

If the uterus be displaced, or if it be enlarged more or less, so that it drags down upon its ligaments, putting them upon the stretch, as well as the nerves which supply it, an irritation is set up which is at once sent back to the sexual center and is reflected to all portions of the body; for instance, the head, producing headaches; the heart, causing pain and palpitation; the stomach, thereby causing gastric irritation and dyspepsia.

Although in a given case there may be no malposition of the uterus, no outward signs of local mischief, no erosion, or leucorrhœa, or others of the annoying local symptoms or abnormal conditions present, still an atrophy of the uterus, or a stenosis, may give the key to remote complaints that have baffled all efforts at relief.

One-half of the ailments of women who have borne children are due to laceration of the cervix uteri.

Lacerations predispose to flexions, subinvolution, relaxation of the vaginal walls, with consequent prolapsus and procidentia, ovarian and tubular congestion, tumors, and, later in life, cancerous degeneration.

There is such a thing as laceration of the internal os when there is no laceration of the external os at all. Lay the cervix open and go deep enough to remove the cicatricial plug.

These "healed" and internal unhealed lacerations of the cervix and uterus are very common, as can be attested by those who have carefully examined the extirpated uterus, or have made careful search for the same when performing trachelorraphy.

Cicatricial tissue in the cervix uteri has a tendency to disappear after the menopause, and the absorption of cicatricial tissue at the menopause will explain freedom from previously existing troubles, especially neuralgia, and improved nutrition in women who have borne children.

The passing of cold steel sounds into the uterus will tone up and strengthen it when it is atrophied and too weak to support itself so that it topples over into the various misplacements; it will restore capillary circulation and reduce hypertrophy when congestion and subacute inflammation have distorted its shape and disturbed its position.

Reflex irritation from a pathological condition of the uterus and its appendages spends its greatest force upon the spinal cord, and, on account of lack of nerve-force, due to nerve-exhaustion, the pain is more intense in it than anywhere else.

Cracked nipples that will not yield to any local medication can be cured in twenty-four hours by cleansing the uterine cavity.

Hypersensitive nipples in women are due to some uterine disorder.

The breast can become diseased as an effect of unremedied uterine pathology.

It is useless to try to cure an induration of the mammary gland by local treatment while an irritation of the uterus and appendages is allowed to remain untouched.

The pain in dysmenorrhea is due to a hyperæsthesia of the endometrium in the region of the os internum and the uterine fundus, and is increased whenever the uterus makes an effort to squeeze something past the os; this pain is then transmitted to the spinal cord, where it is transferred to a motor cell, which sends down the reflex contraction order to the sphincter of the internal os, which, consequently, spasmodically contracts. The pain caused by the contraction or bringing together of the opposite hyperæsthetic surfaces sets up still tighter spasms—and so the vicious circle goes on.

Acne is often produced by some sexual derangement, and by removing the cause the facial blemishes disappear. If the cause is removed the effect will leave.

An irritable, fringed, or thickened hymen, or an hypertrophied labia, and sensitive papillary enlargements, if allowed to continue, will lead to tubular and ovarian disturbances, as well as distressing remote effects.

It is a well-established fact that a more or less undeveloped clitoris attends a delicate female child, and, after a certain age, such a condition proves to be an embarrassment to its proper development.

Small as the clitoris is, compared with the penis, it has. in proportion to its size, five times the nerve-supply of the latter.

An adherent hood may produce such an impression upon the nerve-centers that degeneration of the entire sexual apparatus of a woman may follow.

Liberation of the hood of the clitoris and dilatation of the cervix uteri show a decided influence on the faculties of the mind.

Early attention to preputial adhesions is of the utmost importance, as demonstrated by the fact that with a young woman presenting pelvic pathology an adhesion of some degree is invariably found.

Sexual irritation in some form is a common cause of insanity in women.

Orificial surgery is unquestionably the panacea for insane women, and it will most certainly cure a large proportion of even the most aggravated and discouraging cases.

In a large majority of cases sensuality, pruriency, irritability of mind and conduct, as well as immodesty, come of unnatural or morbid conditions affecting the sexual organs or are affected by the sexual system.

The lower openings of the bodies, with their guarding sphincters, are not merely the orifices of the rectum, urethra, etc., but are the universal gateway for the entire body, the gateway through which the broken-down material for every tissue and organ of the body can pass out from the system; and when you treat these universal gateways of the human system, you not only affect the organs of which they are the mouth, but also affect most profoundly the entire aggregation of organs which constitute the human body.

The nerves of the abdominal viscera are intimately related to the cerebrum and cerebellum, and morbid irritation of the nerves which have their source in these organs will frequently induce morbid states of the mind, which sometimes disappear upon removal of the peripheral irritation, although at other times, when once originated, they preserve an independent existence.

All pelvic affections are caused by some disturbance of the equilibrium of vital energies. Supply and expenditure through the vital organs are, in health, of necessity equal.

It is beyond a question of doubt that insanity may be caused by irritation of the sympathetic nerves supplied to the pelvic organs.

We live by reason of the tonicity of the sympathetic nervous system, and whatever lessens the power of this nerve excites corresponding depression in the peristaltic action of the bowels; hence a torpid digestion results.

Mere functional derangements of the internal organs, such as the brain, liver, stomach, heart, kidney, etc., where the trouble lies in passive congestion and the consequent functional derangement, before interstitial changes have taken place in the organ, respond with such marvelous rapidity to orificial measures as to constitute the most brilliant cures in the history of the work; but where malnutrition has been long prevalent and structural changes have resulted, curative effects are necessarily much slower, as a cure of such cases involves a complete change in nutrition.

In a great many cases orificial work so changes the nutritive forces of the system, and the digestion and assimilation of food are so improved, that a complete transformation of the whole body takes place—those who are emaciated will take on flesh and the body round up, and apparently the individual will look younger by many years; while others, who are obese, will regain a natural amount of flesh or adipose tissue, and at the same time improve in strength.

Many of the cases will yield immediate response to the work and pass on without the use of other measures to a rapid and permanent recovery. Ofttimes, however, orificial work will go no farther than re-establishing a good capillary circulation and increasing the reactive power of the system, having to be followed by other remedial measures to effect a cure.

Every orificialist who has had cases where the vital forces were very low, with thready, rapid pulse and a great nerve-tension, with cold hands and feet, has been surprised at the immediate results upon the circulation.

Removal of pathological conditions of the various orifices of the body does more than to relieve the pain and discomfort in the affected part; it also causes symptoms of distress or disturbance in other and distinct organs or parts of the body. which are many times more troublesome than the local difficulty itself, to disappear promptly and permanently after the operation.

When convalescence commences, symptoms disappear in a reverse order—those which appeared last disappearing first.

Extremities which have been cold for years will, after an operation, be warm; in some instances in a few minutes and others after a few hours.

In any chronic case where the face is pale and sallow, the skin flabby, hands and feet cold, bowels constipated, the whole system torpid, and the mind dull, orificial measures will induce a healthy capillary ciculation, and, in course of time, will cure the case.

There is no form of chronic disease to which it is applicable that it will not cure.

It never disappoints, and should be honored with the motto, " Semper fidelis "—" Always faithful."

It is seldom in chronic troubles that only one organ is affected.

Chronic pathology, in whatever spot it may be located, is not too remote to be a part of the human body; it is not too remote to be influenced by fluctuations in the capillary circulation; is not too remote to be influenced more or less thoroughly and profoundly by orificial measures.

Chronic, persistent, and intractable dyspepsia is, as a rule. due to disturbance of the normal, rhythmic action, through irritation, of the sympathetic nerves at some point; whether it be realized by the patient or not, it is almost certain that either in one or the other of the lower orifices of the body this irritation may be found, and, this being removed, speedy cure of dyspepsia can be depended upon.

It is a well-known fact that the mental functions of the brain may be deranged by the sympathetic influence of some distant diseased organ.

If the bodily forces are kept harmonious, there will never be such a shadow as melancholia, such mental incapacity as may require restraint, or such hallucinations as may drive a patient to destruction of life.

Persons suffering from mental and nervous diseases have, as a rule, inherited a weakness or tendency in that direction, and this tendency has been fanned into a flame by bodily infirmities and unhappy surroundings, and our first duty, when called upon to treat a case, is to remove as far as possible every form of irritation, wherever located.

Insanity is generally caused by irritation of terminal nerve-fibers remote from the brain, and it is an established fact that these terminal nerve-fibers are found in the rectum, uterus, hood of the clitoris, and other parts of the sexual system in both sexes.

Insomnia is due jointly to a debilitated condition of the sympathetic nervous system, giving rise to vasomotor paresis and cardiac enervation, and derangements of digestion, assimilation, and nutrition.

The sympathetic or ganglionic nervous system exercises an important influence upon sleeplessness.

Irritation of the sympathetic nervous system is the cause of all nervous diseases.

Nervous disorders, functional and organic, constitute a large majority of the cases of chronic invalidism.

Nervous prostration means "excess of nervous irritation," and the irritation usually originates from local causes.

Peripheral irritations are the prime cause in many cases of so called neurasthenia.

Every case of cerebral neurasthenia, every headache, every vertigo and dizziness which is accompanied by spinal symptoms, indicates that there is reflex action upon the medulla.

Migraine, spinal congestion, or anæmia and congestive headache, as also neuralgia in various nerves, but especially in the intercostal, all are more or less frequent and persistent associates of pelvic disorders and consequent nervous derangements.

Epileptic seizures are often induced by a diseased and overloaded colon.

The most obstinate cases of asthma will usually yield to orificial measures; a single dilatation of the rectum cutting short an attack.

The neurotic theory of pulmonary consumption shows such a rational connection between cause and effect as no other theory does, and explains why it is associated with disease of the brain, spinal cord, and peripheral nerves.

Pulmonary consumption consists in an exhausted state of the nervous system in general, and of the pulmonary nerve supply in particular, thereby showing that disorder of the nervous system plays a prominent part in the production of pulmonary consumption.

It is a matter of common experience to find patients suffering with pulmonary tuberculosis who are afflicted at the same time with rectal fistula.

Most cases of pulmonary tuberculosis—sometimes in advanced stages, but in a very large percentage in the earlier stages of development—are easily curable by the aid of orificial methods, and those who have anal fistulæ are almost uniformly the easiest ones to cure.

The successful prevention and treatment of phthisis are through measures directed to the nervous system, and in no other way.

These measures are addressed mainly to the peripheral organic nervous system, to a toning up of the vasomotor nerves.

The production of potential or reserve energy, and the expenditure of the same in co-ordinate organic action, is health; failure either to develop this force or expend it in the harmonious action of all elements, tissues, organs, and functions of the body, is disease.

A perfect system of health cannot exist where there is any impairment of the nervous system.

The working of the circulatory system depends upon the nerve-integrity; and to maintain a slowly to-and-fro movement of the blood the cerebro-spinal and ganglionic nervous systems must be at par.

When perfect physiological action is enjoyed, all parts receive the welcome message, " All is well," and pleasure reigns at every vital center as well as every remote extremity.

Irritation of any nerve disturbs to a greater or less degree the whole system.

Pain is but the cry of an irritated nerve; and if the irritation is removed, then the pain ought also to leave.

Excruciating pain, borne for even a short time, or pain of any kind, wherever located, if long continued, will beget a general demoralization of the nervous centers simulating nervous exhaustion.

Pain is one great source of nerve-waste, and the prime duty of every physician is to relieve this so as to husband the nerve-force of the patient.

Pain originating in any part may be transferred to another and weaker part, or to one ready to take on the morbid impression of pain.

Pain is a poor index to the location of cause of chronic reflex disorder.

A worried mind may sympathetically affect the nerve-supply of certain organs to the extent of inducing congestion or inflammation.

Bacteria and vitality are so antagonistic that they refuse to coexist in the same person or part of a person.

Life is dependent upon a repetition of integration and disintegration, processes of building up and breaking down, giving rise to the wonderful phenomena of growth and repair and the universal tendency to reproduction.

There are thousands on every hand who are going into their graves each year for the want of orificial surgery properly applied.

In the light of orificial philosophy, incurable cases are not so incurable as they have previously been supposed to be.

Orificial philosophy teaches that the irritation of an organ starts at its mouth, and that when we remove the irritation the result will be to relieve the sympathetic nerve-waste, and thus correct the whole morbid manifestation.

Stop the nerve-waste first, and then employ the indicated remedy afterward, and not *vice versa,* or the indicated drug alone.

If the pathological changes have not progressed too far, by following out the law of cause and effect and stopping nerve-waste we can cure most of the chronic conditions described by pathologists.

Nature's curative power, "*vis medicatrix naturæ,*" the real physician, provides that all the acute diseases tend toward recovery.

If the barriers to perfect circulation be removed, Nature can thoroughly do her work.

To eradicate a disease and to restore an individual to health: (*a*) Arrest the cause by correcting the perverted functions existing either in the nutritive or reproductive systems; (*b*) re-establish the normal functions wherever they may be out of line; (*c*) if anything then remains to be done, apply that remedial agent which, according to the standard of your own best judgment and in the light of common sense, will remove débris most safely, quickly, and pleasantly.

The total and final removal is the removal of the cause, and if we seek long enough we will find it; its removal will allow Nature to make the cure.

In all pathological conditions, surgical or medical, which linger persistently in spite of all efforts at removal, from the delicate derangements of brain substance that induce insanity and the various forms of neurasthenia, to the variety of morbid changes found in the coarser structures of the body, there will invariably be found more or less irritation of the rectum, or the orifices of the sexual system, or both.

Experience has proven that the pudic nerve, from its five principal terminal branches—namely: (1) Those supplying the bladder; (2) those supplying the rectum; (3) the penis or clitoris; (4) the labia and perineum; (5) the uterus and its appendages or its analogue, the prostate gland and the prostatic inch of the urethra—is the bearer of more messages of discord to the two brains of the body—namely, the extra-cranial, or sympathetic, and the cranial, or cerebro-spinal—than all the other nerves combined, and that irritation of one or more of its branches is responsible for the major part of the reflexes encountered in chronic cases.

If, after a thorough dilatation or after the removal of small points of irritation, quite a severe local condition, which did not before exist, makes its appearance, you may be sure that you have touched the right spot to remove the reflected disorder.

The appearance of this local condition ought to encourage both patient and doctor, for whereas previously the entire system was involved, the trouble is now localized; and although it will be the last spot to get well, when it is well the case will be entirely recovered—reflexes and all.

Orificial philosophy is invulnerable as a theory, thoroughly practical in its application, and destined to make an era in the treatment of chronic disease.

The truths of orificial philosophy are based on well-known anatomical and physiological facts, and cannot be assailed successfully; their universal recognition and application is demanded for the sake of humanity as well as for the reputation of doctors themselves.

Truth is never inconsistent with itself, and the orificial philosophy neither contradicts nor antagonizes any principle or practice connected with medicine that is rational and based upon demonstrable facts.

Orificial philosophy is the greatest truth of the present generation, has come to stay, and will revolutionize the entire practice of medicine in the treatment of chronic diseases.

Orificial operative aid will many times dispense with major operations altogether.

The philosophy of orificial work lies in the removal of all irritations of whatsoever character.

Orificial work is not entirely local in its action, but flushes the capillaries, equalizes the circulation of every part of the body, and institutes profound nutritive changes.

It reddens the parts that are pale, and pales parts that are too red, equalizing the circulation of the blood, and thereby removing all congestions.

It influences digestion, assimilation, circulation, appropriation, and elimination, in skin, bones, and all the viscera.

Orificial work does not mean rectal work alone, but means an inspection of every channel and outlet of the body, more especially, however, in reference to the lower outlets of the body and their repair if any pathological condition exists.

It is a cardinal principle in orificial surgery to let no diseased orifice escape. The work must be " all round " and thorough.

Complete orificial work is essential to success—that is, it must include all the orifices, and be prosecuted at intervals until each and all of them are in a normal condition.

The work consists in smoothing parts that are rough and dilating openings that are unduly contracted, thereby restoring the muscular structures involved to their normal degree of tension.

Orificial treatment removes all causes irritating to the sympathetic nervous system which are producing nerve-waste and depleting vital force, and in doing this the sympathetic nervous system is stimulated, the capillary circulation is improved, the veins are dilated, and impure matter is carried out of the system.

In consequence of increased recreative power in cases where the work unaided is insufficient to restore to perfect health, the properly prescribed remedies that before were inactive or inoperative will now produce the desired effect, and recovery will be possible.

New vigor and vitality are given the patient, and health is restored.

No idea can be formed of the power and influence of this form of treatment, or of the number and variety of diseased conditions to which it is applicable, by anyone who has never had practical experience in the treatment of disease upon orificial principles.

Thorough orificial work is the key to the prison-house of the chronically diseased, whereby the sufferers are set free.

The influence of a thorough, all-round orificial treatment reaches remote organs through its action upon the sympathetic nervous system and its ganglionic connections, stimulating capillary circulation, thereby relieving congestion of parts, improving nutrition, and inducing tissue changes necessary to recovery.

Orificial work is no "cure all," though it has made tremendous strides in dealing with a class of ailments which have heretofore defied every artifice of therapeutics; yet it is often only the key that loosens and starts the rusty bolt of a door that has hitherto yielded to no other summons, no matter how loud and vigorous the knock that has sounded on its panels.

The proper statement of the case would be that orificial measures can render a cure possible, for orificial surgery unaided is insufficient for the great work in which it is so helpful.

We must not lose sight of the fact that ofttimes the work of orificial surgery is but a therapeutic measure which needs to be supplemented at times by all the expedients we can command, making drafts on every department of medical science known to us.

Orificial treatment is not limited to surgery, but embraces every means which will either cure or at least allay peripheral irritation, especially of the orifices.

Failure from orificial operations may be due in many cases to neglect in carrying out the after-treatment.

Upon the management of the cases after the surgical work is done depends much of the success attending orificial work.

Post-operative manipulations and care are as essential as the operations proper, and any surgeon who does not realize and utilize this fact will have many unsatisfactory sequelæ.

The results after an operation are not always instantaneous; time will be required, especially when the operation is purely for the removal of reflex disorders.

The results which the application of these principles secure will compel a recognition of their truth, and of the inestimable value in the relief of human suffering.

The teachings of orificial philosophy are so plain, practical, and effective that they are bound to revolutionize the entire treatment of chronic diseases.

Orificial *philosophy* asserts that a vast majority of chronic diseases and the symptoms attending them are but present phases of reflex disorders.

Orificial *pathology* embraces, comprehends, and treats of morbid structural changes in the various channels and outlets of the body.

Orificial *surgery* is the application of surgical measures.

These principles embody the *essence*, the *germ* of orificial philosophy.

The Sphere of Orificial Philosophy.

Remembering the above facts, which anatomical and physiological study and experiments, as well as clinical experience, have fully demonstrated, we can begin to consider what may properly be the sphere of "orificial philosophy." It is in nervous affections and chronic cases of disease that its sphere of action is greatest.

Of all the diseases which call for orificial work, none will give more brilliant results than will mental and nervous diseases.

Many cases of insanity that would soon have been incurable have been cured or placed on the road to ultimate recovery; many cases of paralysis have been relieved. True, we cannot expect it to cure every case of insanity or relieve every case of paralysis. There are cases of each in which there have been such extensive organic lesions, such structural changes, that no remedy or measure whatever will relieve them; yet, for all that, are we to ignore or reject a measure that will give us such grand assistance, and which aids us to check and cure diseases with which the patients would have had to linger out a miserable existence?

No treatment will equal in any degree all-round orificial work for the cure of that great American bugbear, "nervous prostration."

Eczema, psoriasis, acne, chronic erysipelas, secondary syphilitic affections of the skin, hay fever, bronchitis, and the majority of the skin and catarrhal affections yield more or less to the treatment.

Asthma, rheumatism, headaches, spinal irritation, insomnia, dropsy, subinvolution of the uterus, dysmenorrhea, sterility, chronic endometritis, enlargement of the prostate, seminal losses, gleet, and all forms of malnutrition and chronic congestions, and pathological lesions resulting therefrom, will be benefited by all-round orificial work, for there are very few cases of chronic disease but what present some form of pathological change in one or more of the lower openings of the body.

These pathological conditions cannot always be regarded as the chief factors in the cause of the disease, but they may act as an obstacle to retard recovery, and when they have been thoroughly removed, remedies act more readily, and the circulation, which was tardy and sluggish before, as indicated by cold hands and feet, responds to the stimulus and health comes back. Many of the cases will yield immediate response to the work, and pass on without the use of other measures to a rapid and permanent recovery. Oftentimes, however, orificial work will go no further than re-establishing a good capillary circulation and increasing the reactive power of the system, having to be followed by other remedial measures to effect a cure. There are still other cases, however, that do not call for orificial work, that would not be benefited by it.

Orificial measures must not be depended upon alone to do the work; often this is simply the first grand step in assisting Nature. It must be supplemented by other well-known measures, such as electricity, massage, diet, baths, and the indicated remedy.

Cases in which, before the operation, the chosen remedy seemed to be powerless will now give grand results; cases in which electricity proved to be ineffective will now show steady improvement.

The cases that respond most quickly are those due to passive congestion, before structural changes have taken place; these respond with rapidity to orificial measures.

Organic troubles require time for nutritive changes to take place and build up the diseased structures.

The general average of cases will require from three to six months before they respond satisfactorily; a few will require even one year or two before there is complete restoration to health.

Orificial work is effective in the healing of the sick simply because its measures flush the capillaries and institute universal nutritive changes, thereby awakening into action all the latent energies of the entire system.

It does not fall within the province of this section to describe the several operations which orificial philosophy has given birth to, as they are very graphically described in Professor Pratt's work, "Orificial Surgery," and also in the "Homeopathic Text-Book of Surgery," and especially in the *Journal of Orificial Surgery*, a journal devoted chiefly to the exposition of the principles of the orificial philosophy; but the object is, more especially, to call attention to the various pathological conditions of the sympathetic nervous system, and if possible to elicit more interest in the reflexes and a more thorough study of them.

ELECTRICITY.

The name electricity is derived from the Greek word ἔλεκτρὸν (electron), meaning " amber," from the fact that this force was developed from amber by friction.

The earliest history that we have of this force, which we know as electricity, is 600 years B. C., when the old Greek philosopher Thales discovered that when amber was rubbed it possessed the power of attracting and repelling bodies.

Electricity is one of the many forms of energy similar to light, heat, sound, etc., and has no existence *per se* apart and distinct from the matter which it affects. We know it only by its effects. We know that under certain conditions of matter certain phenomena result, which we attribute to something which we call electricity.

There is a vague idea that vital force and electricity are identical; in other words, that nerve energy and electric energy are one and the same thing, and therefore " electricity is life." We do not know what electricity is; it is known to us only through its effects—it is one of the great invisible forces of Nature. It defies chemical analysis, and cannot be carved with the scalpel. According to Professor Wheatstone, electricity travels over a distance of 288,000 miles in a second, or with a velocity which is sufficient to make the circuit of the earth ten times in a second.

The influence of terrestial magnetism and atmospheric electricity over health and disease is a subject of practical interest to every physician.

Haynes * says: " That it is found in fine weather the atmosphere is almost invariably charged positively; before rain it often assumes a negative state. The rain that first falls is usually negative, although the amosphere before and after the

* " Elementary Principles of Electro-Therapeutics."

fall may be positive. Fogs, snow, and hail, if unattended by rain, are nearly always positively charged. Clouds are always positive."

Dr. Harlan Pomeroy, in an article on this subject, says: "The electric condition of the atmosphere, as a causative and aggravating influence upon diseased action, has not received that attention which its importance would warrant. Many people, without divining the reason therefor, have noted the fact that headache and other unpleasant sensations frequently occurred prior to a thunderstorm. This is due to the electric influence. Thus in a condition in which the atmospheric electricity at the earth's surface is predominantly in the positive or negative state, marked effects may be noted upon the diseases prevailing. It is claimed by some that the proximate cause of disease is electric changes, the type depending upon the polarity. For instance, a long-continued positive condition of the atmosphere predisposes to disease of an active nature—sthenic fevers, etc.; while if this state prevails in moderation, a tonic effect results. If the opposite condition prevails, a lowered vital action prevails: hence neuralgia and low fevers are most prevalent. This accounts for the fact that a long-continued or a marked negative condition of the atmosphere is called unhealthy. In certain states of the atmosphere the negative condition is so excessive that it is almost or quite impossible to generate electricity with the static machine to produce a spark. It is during such times diseases alarmingly prevail."

No one can doubt that the natural electrical conditions of the air we breathe influence health. Scientists assert that all atmospheric states which have been observed to have an unfavorable influence upon health are accompanied by an increase of negative electricity in the air. It is well known that before a thunderstorm an indescribable sense of malaise and oppression is felt by many individuals, and especially by those of a delicate, nervous temperament or who are subject to rheumatism, neuralgia, etc.

At such a time the atmosphere in the neighborhood of the earth is surcharged negatively, and the common expression that a thunderstorm clears the air is scientifically correct; the equilibrium of the two forces of electricity being restored by the exchange in the visible form of lightning between the lower negative and the upper positive layers of air.

According to some recent observations, earthquakes appear to occasion a negative electrification of the air. The electrical condition of the air is subject to daily variations. Every twenty-four hours there is a decrease of electricity, beginning an hour or two after midnight and continuing till shortly before sunrise, when an increase commences and goes on until some hours after sunrise, when the first maximum is attained. The electrical condition of the air then remains stationary for a short time, after which another decrease sets in until some hours after noon, when a minimum is reached. Another short pause ensues, and then a second increase takes place, attaining its maximum some hours after sunset. Then occurs the second decrease, reaching its minimum about midnight.

Atmospheric electricity is greater during the winter months than during the summer months.

In low, damp, malarial regions it is found that the atmosphere is electrified negatively, while the higher we go the more positive does the atmosphere become.

The human body always possesses electricity. In a certain sense every man, woman, or child may be considered a galvanic battery, and each will and does retain a certain amount of electricity, some more, some less. When well and vigorous, they retain a much larger charge than when the blood is impoverished and the nerve-cells are degenerated.

While the free electricity of the body is usually quite feeble, as to its intensity, it is not uncommonly emitted in such quantity as to produce a spark or ignite gas. The organs in which this force resides are the nerves, and it is secreted chiefly by the brain. The chief receptacles are the muscles; they represent, as it were, a Leyden jar, their external surface being negative, while the inner one is positive. The direction of the muscular current is the same as that of the nervous current. " Not only the nerves and muscles, the brain and spinal cord of living animals are possessed of electromotive force, but all tissues in which active nutrition is going on give rise to electric currents." (Althaus.)

Dr. Radcliff claims that the primary electrical condition of living muscle and nerve during the state of inaction is that of static electricity, and that the muscular current and the nervous current, which may pass from the muscle and nerve during the state of inaction, are only secondary phenomena. The natural electricity of the body, termed "animal electricity," is positive, but may be changed into negative by exposure to cold or by sudden, rapid, and violent motion. Positive electricity is increased in winter and diminished in summer, ceasing entirely during perspiration. Animal electricity is not so well manifested in human beings as in certain fishes, as the gymnatus, the malapterurus, the torpedo, etc.*

Many invalids are capable of foretelling changes in the weather by the aggravation or amelioration of their disease, and their change of symptoms will be found to correspond with the changes in atmospheric electricity from positive to negative, or *vice versa,* which immediately precedes or follows a storm. The daily and nightly rise and fall of grave symptoms attendant upon many acute diseases correspond very nearly with the variations in terrestial electricity, and are recognized as occurring with such regularity that the experienced practitioner can often readily predict the condition of the patient for hours in advance. There is a time when the magnetic tides are flowing out from us, and another when they are flowing in; they flow out about four o'clock in the morning, and that is the time when the most deaths occur, the body loses heat, and the coldest time is just before the break of day, so it is the time of the least magnetism and we are weakened in the amount of electric force.

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*The gymnatus, or electric eel, is the most powerful of all known electric fishes. It is to be found in the marshes of Brazil and the Guianas, in the lagoons of Cayenne and South America, and its shocks are so powerful as to kill horses and mules. The Indians are afraid to strike them with harpoons or catch them with a line, since their powerful discharge benumbs their arms, and, if the current should be carried direct to them, instantaneous death would be the result

Magnet, from Magnesia, a country in Thessaly, where it was first discovered, consists of a reddish brown or gray ore found in iron mines throughout the world; it is also called loadstone. These are termed natural magnets. Artificial magnets are those in which the peculiar properties of magnetism are induced artificially. Artificial magnets are generally in the form of a bar or U; the latter are called horseshoe magnets. A horseshoe magnet is three or four times as powerful as a bar magnet. Magnetism, the peculiar property belonging to magnets, may be defined as electricity in rotary or whirling motion; that is, magnetism and electricity are but different properties of the same force or different manifestations of the same force.

Magnets are often of service in forming a diagnosis, indicating the presence and position of needles or small pieces of steel or iron in the tissues, and are frequently a great aid in the removal of foreign bodies. The electro-magnet is the form now generally used for such purposes. Magnets in the treatment of disease are little used, static electricity having almost entirely superseded them.

Definitions of Electrical Terms and General Remarks.*

A *galvanometer* is an instrument for measuring a galvanic current and showing its direction. A *milliampere-meter* is an instrument for accurately measuring the number of milliamperes (milliampere, one one-thousandth of an ampere, the unit of current-strength in medicine) which the patient is taking. The difference between a galvanometer and a milliampere-meter is that in the former instrument the degrees are arbitrary gradations, while in the latter they represent the now universally recognized unit of quantity—the milliampere. A milliampere-meter is therefore the instrument which medical practitioners should own, and all observations should be recorded from the deflections of its needle.

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*We have not space to devote to a description of the mechanical construction of the various batteries, but refer the reader to the many exhaustive treatises on this subject, such as the "International System of Electro-Therapeutics," Liebig and Rohe, Haynes, etc.

A *selector*, or *cell-enumerator*, is an arrangement by which any desired number of cells may be at once brought into the circuit.

A *rheostat*, or *current-controller*, is a contrivance for regulating the amount of flow of electricity. By its use the whole or any number of cells from the series may be used at once. The current can be regulated with perfect certainty, and can be increased or diminished very gradually with absolutely no chance of producing shocks. In all delicate operations it is necessary to use a rheostat, or current-controller, as the addition of cell by cell causes more pain, as each cell gives a little shock. Then, too, the current is not so readily or easily increased or reduced as with a controller.

The *polarity-changer* affords a means of instantly changing the direction of the current; or, in other words, reversing the poles. The pole-changer not only changes the direction of the poles, but also produces the effect of a current-interrupter, while the change in polarity is being made.

The *interrupter*, for the galvanic current, is usually contained in the handle of the electrode; a button is pressed upon, and this, by means of a spring, "makes" or "breaks" the contact.

An *automatic rheotome* is an instrument designed to produce regular interruptions of the galvanic current.

Rheophores are wires connecting the electrodes with the body.

Electrodes are the direct means of applying the electricity to the body.

The *positive pole* is called the anode; the *negative* the cathode. The positive pole is the electrode by which the current enters the body. The negative pole is the electrode by which the current leaves the body. The current in passing from one electrode to another does not pass in a straight line. On this point Stevenson and Jones say: "The path of a current between two electrodes placed upon the body surface is not to be marked out simply by drawing direct lines from one to the other, for the whole of the connecting tissues between the electrodes help to provide a passage for the current, which spreads out from beneath the positive electrode, becoming less and less dense as it occupies a wider and wider sectional area of the conductor, and again grows dense as its lines of passage become more gathered together to reach the negative electrode."

When a charge of electricity is constantly carried off and as constantly renewed, it constitutes a *current.*

Stabile current is the name given by Remark, when the electrodes are kept stationary during a sitting. *Labile,* when one or both electrodes are moved over the surface of the body. Labile applications are preferable to stabile in applying either faradism or galvanism to the muscles. Stabile are preferable to labile when the brain, spinal cord, or peripheral nerve-trunks are to be influenced.

Descending current is the name given it when the positive electrode is placed over the plexus or root of the nerves, and the negative at the extremities.

Ascending current, when the negative is placed over the roots of the nerves and the positive at their extremity or periphery.

The theory regarding the differing effects produced by ascending and descending currents and the rules laid down for their use are now generally disregarded. It was based upon the physiological doctrine relating to the direction of the flow of nerve-impulses. The differentiation in property attributed to the difference in the poles refers partly to the phenomena of electrotonus, and partly to a special influence exerted upon the circulation.

"Superficial" and "deep" or penetrating currents. The superficial, signifies the application of a dry metallic electrode to the dry skin and superficial nerves; while the deep signifies the application of moist electrodes to the deep-seated tissues.

Resistance is whatever impedes the passage of a current through its circuit.

Density is the amount of electricity on a given surface at any moment. When the current is concentrated, it is said to be dense, and it exerts more action than when spread out or diffused over a large area. The density of the electricity will be greatest at those points where it enters and leaves the body, and smaller at any intermediate portion of the same. A current of the same power possesses more density if conveyed by a small electrode than if transmitted by a conductor with a large surface.

Energy is the capacity for doing work, and is measurable by work units.

Electromotive force is the power that urges electricity forward, or causes it to move from one point to another; an electrified body tends to move from places of high to places of low potential; or, in other words, a tendency for electricity to seek an equilibrium. The greater the difference of potential the greater will be the electromotive force. The electromotive force is determined by the number of cells, not their size. The electromotive force of forty elements the size of a tumbler is no greater than from the same number the size of a thimble.

Quantity is the total amount of electricity passing through a circuit in a given time. The quantity of electricity generated depends upon the size of the elements.

Quality or *intensity* depends upon the number of elements comprising the battery—the size of these elements having no influence upon it.

By intensity or tension is indicated the capacity of a current to overcome resistance. Intensity may be illustrated by the passage of water through a hose nozzle. If the size of the opening be diminished, the stream becomes more dense; that is, there is a diminished quantity, but the force or intensity is increased.

Electrolysis is the separation (a chemical decomposition) into component parts of a compound body by passing electricity through it. Electrolysis can only occur when the substance is in a liquid form or semi-liquid state, so that the particles can move freely. Electrolysis can be obtained only by means of the galvanic current.

Cataphoresis is a term by which is meant the introduction of medicaments, by means of electricity, into the body through the skin or mucous membranes. In this manner anæsthesia may be produced with a solution of cocaine, morphine, or chloroform, and other drugs may be introduced into the circulation for medication of local lesions; for example, the introduction of iodine into a goiter by saturating the sponge of the positive pole with it.

Polarization is due to the accumulation of bubbles of hydrogen upon the carbon, and of oxygen upon the zinc elements. These bubbles of oxygen and hydrogen set up a counter-current in a cell, and this current flowing in an opposite direction to that of the battery current has a tendency to weaken the latter, and eventually may neutralize it. Then we say that the battery is "run down" or "weakened." Of course, after the battery has been at rest, the current recovers to a degree, but never regains its original strength, and disappears again after a certain amount of work.

Ohm's law is that the electromotive force divided by the resistance is equal to the strength of the current.

General electrization consists in passing the current through the main part of the system, which may be accomplished by placing the feet on a moist copper plate connected with one pole, the other electrode upon the head, neck, or hand.

Localized electrization consists in limiting the current as much as possible to certain organs or tissues, such as a limb, muscle, or nerve. The smaller the electrodes and the nearer they are together the less diffusion of the current there will be and the more local will be its action; the larger the electrodes and the farther apart they are the greater will be the action on the system in general, but the less will be their local action. Althaus says that an absolute localization of electricity is therefore impossible, and if we speak of localized application, this is only relatively true. It is easier to localize the induced than the continuous current, because the quantity is so large that it will spread to a considerable distance from the electrodes.

The human body is a poor conductor. The resistance of the body is more than twice as great as that of the Atlantic cable. The resistance is greatest where the skin is thick and dry, and least where it is thin and moist. The resistance is greater in young people than in old. The mucous membranes conduct better than the skin. A scratch or an abrasion lessens the resistance, and this is the reason that when passing the electrode over the surface of the skin where there is a scratch or an abrasion the patient complains of its being so painful; a greater amount of electricity enters the body at that point. In some individuals the resistance is greater than in others, and even in the same individual it varies at different times.

According to the researches of Ranke, when the current has once overcome the resistance of the cuticle and bones it will spread almost equally through all the organs which are interposed between the two electrodes, the greatest effect being always produced near the electrodes.

Resistance is less when the skin is covered with perspiration. The conductivity of the skin is improved by moistening it; and again, the resistance is still further lessened by using a saline solution, prepared by putting a little common table salt in the water with which the sponges are moistened, or a solution of common baking soda. The soda solution has the advantage of the salt solution in that it does not corrode the electrodes, but has the disadvantage that greater care will have to be exercised in its use, for if by accident it should come in contact with certain kinds of dress goods while applying the current, the consequence is a stain in the cloth. It is estimated that by using either one of the solutions the resistance of the skin is lessened fifty per cent. A saturated solution of salt conducts 720 times better than fresh water. It has been estimated that the human body, owing to the salt that it contains, conducts nearly twenty times better than water. When the electrodes are applied to parts of the head covered with hair the hair should be moistened, as dry hair is a non-conductor.

The electrodes may be covered with sponges, Canton flannel, or absorbent cotton. The objection to sponges is that they soon become filthy and dirty. Too often physicians become careless in their use, and will continue to use upon the most delicate and sensitive patients dirty sponges saturated with perspiration absorbed from many individuals; sponges which for one moment they would not tolerate upon their own person. The advantage of absorbent cotton is that it can be changed frequently, little expense being incurred. The flannel covers can be removed and washed. The cotton or flannel can be held in position by slipping a rubber band over the stock of the electrode. If it is the desire to act principally upon the skin, the electrode should be used dry, for a dry electrode will act more on the skin and less on the muscles, while moistened electrodes will act less on the skin and more on the muscles. If a limb is to be subjected to the electric influence, it may be immersed in water in which is one electrode, the other being placed on some portion of the body to complete the circuit; or two dishes of water may be used, one for each limb, each containing an electrode.

The size of the electrodes is of importance in treatment. The density of the current being greater at the point of contact on the surface of the body with a small than with a large electrode; therefore, if we should desire to concentrate the current upon a certain organ or part, the small electrode should be applied to or over this organ or part, and a large one at some indifferent part of the body.

The questions are often asked, How frequently should an electrical treatment be given? and, What period of time should constitute an electrical course? In regard to the first question, the frequency of the applications will depend upon the nature and severity of the case. In some cases the treatment will have to be given every day until relief has been obtained or until there are decided indications of improvement. This will only have to be resorted to in rare instances. Usually the treatment should be given every other day or every third day for a period of from twenty to thirty days, and then once a week while the course lasts. In regard to the second question, as to the length of the electrical course, it also will vary in different cases. Generally speaking, however, it is necessary to use electricity for a month or six weeks.

Occasionally one or two applications of electricity are sufficient to cure a patient; as in hysterical aphonia, muscular rheumatism, neuralgia, and amenorrhœa. A good rule to follow is that as soon as the patient is completely relieved of the trouble for which he sought advice, discontinue the treatment and wait for developments; for in some instances to continue the treatment after the patient is well may even prove harmful. In chronic cases that require long-continued electrical treatment it is better, after using it for a month or six weeks, to discontinue the treatment for a short time and then later to recommence it.

The strength of the current must be graduated according to the sensation of the patient. It is better to commence with a mild current and increase the strength gradually. The amount of electricity to be given in any case will vary according to the age and condition of the patient, and the locality to which the current is applied. Some patients can stand much more than others, and again, certain parts of the body are more sensitive to the action of the current than others.

Haynes * says "It may be laid down as a general principle that a feeble current used for a short time produces the greatest

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* "Elementary Principles of Electro-Therapeutics."

therapeutical effect; that a powerful current almost always does harm instead of good, and more especially so when it is applied for a considerable length of time." It may be added that but little benefit is likely to follow torture, and that no needless pain should be inflicted upon the patient.

Electricity given in such a way as to frighten or excite a patient or hurt him does more harm than good. A current so strong or applied so long as to produce soreness of muscles, cramps, or great fatigue does more harm than good. Too weak a current can never do harm, but too strong a current is capable of producing irreparable mischief.

The popular idea seems to be that if a little electricity will do good, more must be better. The patient is anxious for recovery; the doctor wishes to make a favorable impression and frequently yields to the request " to put it on stronger," often to the damage of the case. A good rule to follow in making electrical applications is to always begin the electrical treatment with the current at zero, thus lessening the danger of a sudden shock to the patient; and before removing the electrodes or breaking the current, reduce the current to zero; this avoids the danger of short-circuiting the battery.

If a patient complains of feeling dizzy or faint during a treatment, it is indicative that the current is too strong and should be reduced; but generally, under such circumstances, it is better to defer further treatment until another day. It occasionally happens that patients do not bear electricity well; after an electrical treatment they may be subject to headache or are nervous and sleepless the following night. In such cases electricity will have to be employed very carefully. In many of these cases after a few applications of a very mild current these nervous symptoms fail to make their appearance and the patient may enter upon the regular electrical course; while in other cases the electrical treatment will have to be abandoned entirely.

In regard to the length of a sitting, the time will vary in different cases, from three to thirty minutes; applications to the head requiring a shorter sitting than applications to the body; also when giving static electricity the sitting is usually longer than when using the other currents. As a general rule, however, the duration of each sitting should be about ten minutes; but the time may be shortened or lengthened as may seem advisable to each particular case.

As a remedial agent in many forms of diseases electricity has assumed such an important position—a position rendering it worthy of being termed a polychrest—that the study of its nature and its action upon the human system in health and disease is absolutely essential to an earnest physician or surgeon who has a regard for the best interests of his patients.

The therapeutic sphere of electricity is sufficiently wide to be justly considered remarkable without proclaiming it a " cure-all " or a " panacea for all human ills." Its chief field, however, is found in that large class of neuroses, such as hysteria, epilepsy, paralysis, neuralgia, and spasmodic affections which so frequently baffle us when other therapeutic agents are employed with but little success; also, those disorders well known to be influenced by change in external circumstances of weather, seasons, and climate. Electricity at one time or another has been used for every disease under the sun, and, like every other measure for the treatment of disease, has been overrated, carelessly employed, and then pronounced to be worthless by individuals who are ignorant of the first principles of its use, who have, without paying any attention to the special symptoms of the various cases, undertaken to treat every case by this means.

Too much is often expected of electricity. We must not expect from electrical treatment that which it does not or cannot accomplish. We must not expect it to perform miracles, to relieve or cure affections in a few days that have resisted all forms of medication. We must not expect electricity to replace sclerosis with normal nerve-tissue, or that hopeless, incurable paraplegics may be caused to walk.

What can we expect to accomplish with electricity? We may expect by means of electricity to augment the circulation of the blood, to promote absorption, to quicken torpid nutritive processes, to excite secretion, to improve digestion, to stimulate muscular action, to revive nerve-activity, to heal ulcerations, to dissipate strictures and tumors, and to cauterize and destroy abnormal growths.

Electricity seems to have the power to restore the nervous equilibrium, so to speak, when disturbed. It also seems to have the power to arouse into activity nervous centers which temporarily, from functional causes, have become dormant.

Electricity is the best therapeutic means at our disposal to combat pain, hemorrhage, and impaired health and strength. Above all local means, not only for relieving pains of any particular paroxysms, but of affecting a permanent cure, electricity stands first.

Electricity, when intelligently administered, gives most brilliant results in an increase of vital power. It is " Nature's own remedy," and restores vitality by its constitutional effects, and prolongs life in comfort and enjoyment.

It promotes nutrition of every part it excites; produces marked local and general circulatory effects, and stimulates the vasomotor system.

It increases both the appetite and the body weight when the latter has been reduced by impaired nutrition.

In the treatment of paralysis of curable forms it is one of the most successful agents we have.

In paralysis due to injury or diseases of the peripheral nerves, electricity does good in promoting and hastening cure, or in starting into activity again a stagnant reparative process. Muscles that have become too much enfeebled to move the limbs will often be restored to full function in a remarkably short space of time.

Neuralgia, when of idiopathic origin, is more successfully treated to-day by electricity than by any other medicinal agent. In many instances it is cured in a few sittings.

In chorea it soon restores the equilibrium and allows the development of the system into manhood or womanhood without further trouble.

Neurasthenia or hysteria manifesting themselves by dyspeptic symptoms are always benefited, if not cured, by electricity.

In hemiplegia, the result of cerebral hemorrhage, electricity should be applied to the brain to cause absorption of the extravasation, and the progress toward recovery is far more rapid if a peripheral application to the nerves and muscles of the paralyzed extremities is combined with the central application. Caution, however, should be used in the use of electricity about the head where there is disease of the brain.

Electro-therapy in every disease where the nervous system is a factor will greatly help, if it does not of itself alone effect a cure. No one who has not had a practical experience in its use can form an idea what power it has.

In the removal of the inflammatory deposits and adhesions in gynecology, electricity gains the most glory.

Functional diseases of the uterus or ovaries may be relieved quite promptly by a properly selected current.

In neurotic conditions removal of the uterine appendages is not only useless, but often leaves the patient worse off than she was before. The neurosis will almost always persist until the accompanying uterine disease has disappeared, and this can best be accomplished by the judicious use of electricity.

In the treatment of the various morbid conditions of the ovaries, in electricity we have an agent which in many cases will accomplish a cure by less heroic means, more safely, and with less suffering than can be done by any other method.

" I can recall case after case of amenorrhœa in stout women who have been made to menstruate; sterile woman who have been made to conceive; of women who have suffered untold agony at their menstrual periods, and for the most time between it and the next, who have been made to see the flow come without the slightest pain; and as to menorrhagia, I have never known it to fail." (A. Lapthorn Smith.)

Uterine hemorrhage is more certainly controlled by electrical energy than by any other known remedy.

Subinvolution is more successfully and quickly treated by electricity than by any other means.

Electricity will have to be employed very carefully where there are indications of cysts or purulent formations in the tubes or ovaries.

By the use of electricity many of those hitherto incurable diseases of the spinal cord are cured, many more are arrested, and in but a very small number does a judicious use of electricity fail to palliate the severity of the symptoms.

Electricity is not simply a stimulant to stir up paralyzed muscles; it possesses tonic and sedative properties, and is not alone a sedative, but, by restoring normal nerve-action, improves the nutrition and circulation.

Cases should be chosen for electrical treatment, for every case is not amenable to its use. Some diseases are affected more than others; while in still others no benefit whatever can be obtained from its use; in fact, its use would be positively harmful. On the other hand, there are affections in which electricity will do more good than all other measures combined.

Electricity should not be depended upon alone to cure a case, but should be judiciously used in connection with internal remedies. Notwithstanding many cases could be cured by electricity alone, yet, in the majority of cases, a simultaneous internal treatment is of the greatest importance, and should not be neglected if we wish to increase the chances of success. In many instances it will pave the way for, or act as a supplement to, the indicated remedy.

The effect of electricity is far-reaching and of long-continuous action. It traverses the tissues to their innermost depths, and produces profound modifications of structure and function in nerve and muscle, enduring for weeks after a single electrization.

In the use of electricity some physicians are more successful than others. This depends in part upon the judgment with which suitable cases are selected for treatment, but chiefly upon the details given to treatment; success depends more upon this than upon the form of electricity employed.

We must learn to recognize not only the diseases most amenable to electric treatment, but also the method of application best adapted to each case; we must also study accurately the effects of different doses of the current, for, as Althaus * points out, there is reason to believe that small doses have contrary effects to those of large doses of the same agent.

FORMS OF ELECTRICITY.

As to the forms of electricity, long usage sanctions, in medicine, the divisions of electricity into the *galvanic*, the *faradic*, and the *franklinic* currents, to which has lately been added what is termed the *sinusoidal* current.

Fundamentally all electricity is one and the same, but the various forms differ widely from each other in intensity and quantity and in their effect upon the organism.

Upon this subject Cowl † says: "The three common forms of electricity, which we know as galvanic or constant, as faradic or induced, and as franklinic or static, result from their different manner of production, and are distinguished from each other by their rate and manner of discharge, which is constant and continuous in the case of galvanism, intermittent, inconstant, and alternating in direction and intensity in faradism, and intermittently instantaneous in franklinism. . . . Respecting the effects of electricity on the organism, we find them of two fundamental kinds—namely, first, functional and second, molecular; and these are combined in different proportions in the case of each of the three common forms of current. In the strengths employed on the organism, the galvanic current produces the least functional and the greatest molecular action; the franklinic discharge, on the other hand, the least molecular, and, for the same quantity of electricity, the greatest functional effect, while the faradic current holds an intermediate place."

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* "Medical Electricity."

† W. Y. Cowl, M. D., Berlin, "Action of the Galvanic, Faradic, and Franklinic Currents," *Journal of Electro-Therapeutics*, January, 1895.

Regarding the choice between the different varieties of electricity, sometimes one variety is most effectual and sometimes another. A physician cannot limit himself to any one of the varieties. We cannot say that the galvanic current is adapted only to one class of diseases, the faradic to another, and the static to still another. Although each current possesses peculiar properties of its own which distinguish it from its fellows, yet they are, in a greater or less degree, mutually interchangeable in all their important properties. Each of these currents has its field and its indications, which will be described later, but they all have this in common—namely, *the capability of rousing the vital energy of the nerves.* Seldom is a patient treated by any of these methods whose general health, weight, facial appearance, and feeling of well-being are not notably improved.

Galvanic Current.

(*Galvanism.*)

The galvanic current is so named in memory of Galvani of Italy, who first discovered it in 1780. It is also referred to as the direct current, because flowing directly from the battery cells; constant or continuous, because the current flows without interruption; voltaic, after Professor Volta, who discovered a new and powerful method of producing this current—namely, the voltaic pile, from which all the galvanic batteries of the present day have been developed. This form of electricity is generated by chemical action. When the galvanic current is artificially interrupted, it is known as the *interrupted galvanic current.*

In the galvanic current, the electricity always flows from the positive to the negative pole. The positive pole soothes, while the negative stimulates, excites, and is more harsh and irritating. When the two poles are applied to the body and the current turned on, the most chemical action and pain is produced where the current emerges from the body, and that is at the negative pole. This action of an electric current has been compared to the effects of a bullet passing through the body, in which case the greatest lesion exists at the point where the bullet passes from the body.

To detect the direction of the current—that is, which is the positive and which is the negative pole—immerse the metallic tips of the conducting cords in water (a saline solution is better than pure water); the tip around which quickly gather bubbles of hydrogen is the negative; the blackening of the metallic tip at the positive pole will give similar indication; also a solution of iodide of potash and starch, when brought under the influence of the current, will give a blue color at the positive pole, while at the negative pole the solution remains colorless.

To detect whether any current is flowing or not, touch the tips of the conducting cords together. If there is a current flowing, an interruption of this current will produce a spark; or, when one sponge is applied to the patient, take the other one in your hands, moisten the tips of the fingers or the palmar surface of the other hand, and make contact with the patient's body. A very delicate test is to place the electrodes against opposite sides of the face or tongue, when strong burning or prickly sensations will be felt on interrupting the current; or again, if the electrodes are placed upon opposite sides of the temples, flashes of light will occur on moving the electrodes.

The head and body is inclined toward that side where the positive pole is applied during the whole time the current is flowing, but on breaking the current they are turned toward the side corresponding to the negative pole.

At and about the positive pole collect acid products, and at and about the negative pole alkaline products; and if the remaining intra-polar regions be microscopically examined, structural changes peculiar to each polar nucleus will be found to shade off in a degree toward the neutral central portions.

The electrode whose special action is desired is placed in the nearest possible relation to the tissue to be affected, while the other electrode is placed at some remote part of the body, and this electrode is termed the *indifferent* electrode. Kellogg calls attention to the fact that, if the concentration of an electric current in the anterior half of the body is desired, the electrode must be proportioned in size according to the distance of the point at which it is desired to concentrate the current from the pole designed to be the active one. Further he says: " Two large electrodes of equal size, placed upon opposite sides of the body, will concentrate the current at the center of the body, or midway between the two electrodes. If one electrode is made smaller than the other, the point of concentration will be proportionately nearer the small electrode."

The indifferent electrode should be constructed of large dimensions, in order to spread the current strength employed over a large area.

The electrodes must be in direct contact with the skin or other tissues to be treated, as the current will not pass through the clothing.

Always press the electrodes firmly and evenly against the part which it touches. This renders the current employed an even one to the patient, and assists in its conduction. Always endeavor to apply one of the poles to the part which is diseased.

The negative pole has a stronger effect on the nerves of the skin than the positive. Often the patient will complain of a burning sensation at the negative pole, while at the positive pole no sensation at all is felt.

Hyperæmia and erythæmia are more easily produced in women and in persons with a delicate skin; and are more marked at the negative than at the positive pole.

The negative pole—stabile—of the continuous current possesses the most value in the absorption of exudates. This may be due to the principle of cataphoresis, according to which an increased amount of fluid is directed to the cathodic end of a semi-fluid electrolyte. (Morton.)

At both poles there is a primary contraction of the arterioles, which quickly at the negative pole, and less quickly at the positive pole, becomes a dilatation.

The anode or positive pole of a galvanic battery is the sedative pole, and the cathode or negative pole is the stimulating or irritating pole.

In using the continuous current there is only a contraction on closing the circuit, whether the closing or opening is effected with the positive or negative pole. At the cessation of the current there is no contraction at all.

The galvanic current is a powerful stimulant for all the different portions of the nervous system, and these stimulating effects become more particularly developed where an intermittent application is resorted to. It has the power of awakening the excitability of a nerve after all other stimulants have ceased to act.

When a muscle has lost all power of responding to the stimulus of a faradic current, in many cases its sensitiveness may be restored by the application of a tolerably strong galvanic current. In many cases of peripheral paralysis galvanism will surpass faradism. It increases the activity of a gland, and consequently the secretion.

In the acute pains of facial neuralgia and the persistent aches of spinal congestion the judicious use of galvanism has succeeded better than any other form of treatment.

The polar and intra-polar electrolytic action of continuous currents produces profound modifications of structure and function in nerve and muscle; in fact, the electrolytic action of the galvanic current is one of its most important properties.

Galvanism exerts a powerful influence on the vasomotor and trophic systems of nerves. It produces direct stimulation of the vasomotor nerves, which latter transmit the influence to the blood-vessels and lymphatics. In this way the process of nutrition throughout the system may be influenced. Galvanism of the cervical sympathetics is one of the best methods to effect this result. By catelectrotonus of the vasomotor nerves absorption is promoted, and effusions may thus be removed into the general circulation.

The sedative effect of the anode determines its use in neuralgia, sciatica, spasms, and tinnitus aurium, while the stimulating effects of the cathode and the greater ease with which it causes muscular contraction have determined the use of the negative pole in paralysis.

In galvanism the effects of the poles are everything in therapeutics, each pole having its special field of action and its special indications.

The polar action of the positive pole may be said to be anodyne, sedative, congestive, denutritive, and anti-hemorrhagic or hemostatic.

The polar action of the positive is known as the coagulating pole, and the negative is the liquefying or dissolving pole and that which promotes absorption. The negative favors absorption by liquefying the tissues. The action of the positive pole is that of a hemostatic. When a nerve is subjected to the influence of the negative pole, its excitability is increased (catelectrotonus); when subjected to the influence of the positive pole its excitability is diminished (anelectrotonus).

In galvanism we have an agent from which two forms of cauterization can be obtained, according as to which pole is employed; the positive producing an acid cauterization, the negative resembling that produced by a caustic alkali.

The eschar resulting from the caustic action of the positive pole is firm, dense, and retractile, while that of the negative pole is soft and yielding.

Only the negative pole should ever be used when making applications to the urethra.

The negative pole in the uterus when you want to stimulate it to increase the blood supply. The positive pole in the uterus for endometritis and hemorrhage. The positive pole in the uterus when it is soft and congested; the negative when it is hard and you want to relax it.

Atrophy of the uterus or an undeveloped uterus—negative pole in the uterus, positive pole on the abdomen or over the lumbar region.

The most powerful contractions of the uterus occur when the current is directed from the spine to the cervix—that is, positive pole to spine and negative pole to cervix uteri.

The negative pole of the galvanic current has the power to soften and dilate a stenosis of the uterus.

The positive pole should rarely, if ever, be used in the uterus or vagina when there are any indications of pus-accumulation in the tubes. A continuous current, applied externally over the abdomen, above the pubes, is of marked benefit in cases of scanty menstruation.

In using galvanism through the intestines, the electrodes should be widely separated, lest painful contractions occur.

When the positive pole is applied to the sacrum and the negative to the nape of the neck, it produces a metallic taste, such as copper or iron.

Galvanization of the vagi stops the heart's action, and is a dangerous procedure.

In regard to choice of polarity in any given disease, Professor Morton * has advanced the hypothesis that both physiological and pathological chemism (metabolism) must exhibit a polarity which he has termed "metabolic polarity," and has proposed, as a basis of treatment, that a given polarity of disease have applied to it an extraneous battery polarity of the same or an opposite name, in order to augment or diminish the chemical exchanges underlying it. Of the working of this hypothesis he says: "It follows that when chemical exchanges—viz., metabolism—are excessive (*a*) a positive pole will increase the excess, augmenting the disease; (*b*) a negative pole will diminish the disease; but if the chemical exchanges are underactive, (*a*) a positive pole will increase the underactivity; (*b*) a negative pole decrease it. In overactivity of metabolism a negative pole, in underactivity a positive pole is palliative or curative."

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* "International System of Electro-Therapautics."

Applying this hypothesis to the treatment of disease, he would apply the negative pole to all inflammatory processes and the positive to all degenerative processes—that is, in those processes which are underactive.

We, as homeopaths, would simplify this by saying that he was applying the law of "*Similia similibus curantur*"; that is, that the poles are selected according to the law that if a remedy given to a healthy individual will produce a set of symptoms or a condition, that if those symptoms or that condition is met with in an unhealthy individual, that remedy will palliate or cure those symptoms or those conditions. This law is applied also to electro-therapeutics. Thus, for instance, the negative pole applied to a healthy individual will produce congestion, and if pushed far enough will result in inflammation; therefore in an inflammatory condition the negative pole should be employed to combat it; the positive pole produces an anæmic condition—underactivity—and therefore is indicated in torpid or degenerative conditions.

Dr. Pomery, in a lecture delivered before the Hahnemann Society of Cleveland, Ohio, January 19, 1886, well expresses the truth when he says: "The more the subject of electricity is investigated by one who understands and appreciates the homeopathic law of cure, the more thoroughly will he be convinced that in bringing about a cure of a diseased condition electricity acts according to the law of cure expressed by the phrase so familiar to you all, 'Simila similibus curantur'; that is electricity is capable of producing certain symptoms in the healthy subject which are similar to symptoms in the diseased subject that the agent relieves. Lightning has been known not only to cause but likewise to cure paralysis."

It is known that the anode virtually paralyzes the vasomotor nerves, thereby producing congestion and œdema.

Remark advises to place the negative pole to the inflamed part, and the positive pole to some indifferent part; but as soon as symptoms of effusion are present, the position of the electrodes should be reversed. Again, where the character of the inflammation was erethetic—that is, in a state of increased sensibility and irritability—the positive and where there was torpidity, the negative pole should be employed with preference near the seat of disease.

Subaural Galvanization.—This term has been applied by Dr. Watteville to a method of treatment in which the negative electrode is placed just below the ear, and the positive over the cervical and upper dorsal vertebræ, a current of 5 to 10 cells being placed for from three to four minutes on one or both sides.

Galvanization of the Sympathetic.—Althaus gives the following methods: (1) One electrode is placed in the auriculo-maxillary fossa, and the other on the transverse process of the sixth or seventh cervical vertebra, on the opposite side of the body. By proceeding in this manner, not only the upper cervical ganglia are affected, but the spinal cord and the base of the brain likewise receive the ganglionic influence. (2) One electrode is placed in the auriculo-maxillary fossa, and the other at the manubrium sterni, at the inner edge of the sterno-mastoid muscle. This mode of application affects not only the upper and lower cervical ganglia, but also the pneumogastric, the depressor nerve, the laryngeal, and the descending branch of the hypoglossal nerve. (3) One electrode is placed in the auriculo-maxillary fossa, and the other inside of the cavity of the mouth, opposite to the articulation of the lower jaw. This mode of proceeding would localize the current in the upper cervical ganglia of the sympathetic.

Galvanization of the sympathetic produces a feeling of sleepiness and drowsiness, which commences soon after the current is closed, continues during the application, and for some time after the current has been broken.

Central Galvanization.—Beard has proposed a method which he calls central galvanization. He recommends that the negative pole be applied to the epigastrium, while the positive is applied over the head, around the sympathetic, and down the whole length of the spine, in such a way as to bring the brain, the pneumogastric, the spinal cord, and all the prominent plexuses of the sympathetic—indeed, the whole central nervous system—under the influence of the current. The negative pole should be placed on the pit of the stomach, because it is well borne there, and because the descending current (electricity flowing from the positive to the negative pole) seems to act better in most cases than the ascending. The positive pole is less acutely felt than the negative and is less irritating, and he thinks it is not unlikely that this fact may explain the more satisfactory results of the descending current in central galvanization.

This method of applying electricity is especially useful in those nervous affections (hysteria, neurasthenia, sleeplessness, and dyspepsia) characterized by nervous exhaustion, the muscular strength and the general nutrition not being much impaired; or, in other words, in cases where the symptoms are not very well defined, and where there is a low state of nervous power throughout the system.

In beginning a treatment always begin with a mild current and increase, if necessary, as the patient becomes more tolerant of its effects. It is rarely necessary to employ a current so strong as to cause distress; but it is necessary to produce a plainly perceptible feeling of pricking and of heat; also the current should be given sufficiently strong to produce a metallic taste in the mouth when it is applied to the head and neck. Vertigo should be avoided if possible. The duration of treatment should be about ten minutes, the sitting should be twice or three times a week, according to the severity of the case, until twelve or fifteen applications have been given, or until decided improvement has set in, and then once a week until five or six have been given.

A modification of the above method, and one which answers for all practical purposes, is to place the positive electrode (a large one) to the nape of the neck and the negative (a small one) over the pit of the stomach. The electrode over the pit of the stomach should be held stationary for about five minutes and then moved over a larger area, usually including the greater part of the abdomen in the circuit. The whole duration of the treatment should be about ten or twelve minutes.

The concentration of the current over the pit of the stomach by means of a small electrode stimulates the *great solar plexus*, or " abdominal brain," as it is sometimes called, which is located near the median line of the body, under the pit of the stomach. The solar plexus is the great nervous center of nutritive life—that is, its office is to govern the nutritive vital forces of the body; also it has direct control over all the secretions of the abdominal and pelvic viscera. Therefore, in stimulating the solar plexus, the very center of the mechanism of organic life is influenced.

General Galvanization.—General galvanization, which was brought into prominence by Beard and Rockwell, is done as follows: One electrode is placed upon the feet; it should be so large that it can be retained *in situ* during the sitting without discomfort. The other electrode is then passed successively over the different parts of the whole body—the limbs, the back and the spine, the abdomen, the neck, and, lastly, the head. The object sought is two-fold—the stimulation of the whole nervous system through the muscles, skin, and peripheral nerves, and the inhibition of morbid central nervous processes.

Faradic Current.

(*Faradism.*)

The faradic current is named after Faraday, who in 1831 discovered that a galvanic current passing through a wire induced a current in another wire near to and parallel to it. This current is also known as the " induced " or " interrupted " current. While the faradic current is generated by the same elements that generate the galvanic current, still it differs widely from that current in its properties and therapeutic effects, for while the galvanic is a continuous current flowing in one direction, the faradic is an indirect, induced current—an interrupted current; the current from the generating cell being modified by passing through a helix inclosing a bar of soft iron or a bundle of soft wire—or, rather, this core of soft wire becomes magnetized as the current is broken.

In speaking of the polarity of the faradic current, Walling * says: "I am glad to notice that many of our best electro-physicists now regard the faradic or induced current not as a to-and-fro current, as heretofore claimed, but as an interrupted induced current, with a flow in one direction only, consequently having a strict polarity, and that the faradic current possesses the same essential characteristics as the galvanic, only in a lesser degree."

On this same point Mayson says: "Each electrode is alternately anode and cathode, but the direct current is so much stronger that it may alone be considered; and this current being understood, we may properly speak of positive and negative pole in reference to faradism."

The negative pole can always be distinguished from the positive by its sharper current and greater effect on motor and sensory nerves. In the short, heavy coils the negative pole is more marked than in the long fine coils; as a rule, however, very little attention is paid to the polarity of the faradic current, as the influence of the pole is reduced to a minimum.

Most faradic batteries have two currents—viz., the *primary* current of the thick wire and the *secondary* current of the fine wire. Duchenne claims that the difference in the physiological action of the primary and secondary currents is due to the fact that the former acts chiefly on the contractile power of the muscles, while the latter has more effect on the sentient nerves. Becquerel claims that the difference in the physiological effects of the two currents is chiefly due to the difference which exists between the tension of a short thick wire and a long fine wire.

The shorter and thicker the wire constituting a coil the greater quantity of electricity, while the quality or intensity is diminished. On the other hand, the longer and finer the wire the less the quantity, while the intensity is increased.

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* "International System of Electro-Therapeutics."

The primary current has very little effect upon the skin, it excites more acutely the subcutaneous organs, and especially the contractile power of the muscles, which are better conductors than the skin. The secondary current possesses a high tension and affects the muscles less and the nerves more than the primary current. It also affects the sensibility of the skin more intensely and produces more marked reflex contraction than the primary current. In short, the difference between the two currents may be summed up as follows: The primary current is a current of volume; the secondary is a current of tensity. The primary produces stimulation; the secondary sedation. The primary acts on the muscles; the secondary on the nerves.

Haynes * makes the following comparison of the primary and secondary currents:

1. The primary current is composed of a single induced current, always going in the same direction.	1. The secondary current is composed of two currents going alternately in contrary directions.
2. The primary exhibits galvanic properties, in that it deflects the galvanometer and possesses feeble electrolytic power.	2. The secondary does not deflect the galvanometer, although it may cause a very delicate needle to oscillate slightly.
3. The primary has more power to excite the sensory and motor nerves of the muscles.	3. The secondary excites more acutely the cutaneous nerves and penetrates more deeply into the tissues.
4. The primary is relatively less rapidly interrupted.	4. The secondary possesses distinct properties in virtue of its rapid interruptions, and far surpasses any other form as a stimulant to the nerves of sensation.

The sensations produced by the faradic current will vary according to the tension of the electricity used. If the electricity be of low tension, it causes a slight pricking sensation; while if it be of high tension, intolerable pain may be produced.

Induction currents are instantaneous. The contractions caused by them occur in quick succession, and there is no time for perceptible relaxation. The contractions are so rapid that they appear continuous, the intervals between being too short to be distinguished. According to Engelmann, muscu-

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* "Elementary Principles of Electro-Therapeutics."

lar contractions cease when the faradic interruptions are 5000 per minute.

The effect of the faradic current varies with the number of interruptions. Sedative effects are best attained by the utmost frequency of interruption, a rapid interruption—20,000 to 50,000 per minute. On this point Dr. W. F. Hutchinson says: "While it is true that general suffering must yet be fought with some drug that will rapidly pervade the system through the circulation and allay it by impressing nervous centers, I believe that the time has come to announce *that all forms of localized pain, not dependent upon structural changes of nerves or nerve-centers, or destructive metabolism of other tissues, may be relieved promptly and effectively and often cured by an induced electrical current whose interruptions are sufficiently frequent and whose strength is small.* Also that by the same means there may be produced a local skin anæsthesia sufficient to permit of minor surgery, such as opening felons, being made."

This analgesic and anæsthetic condition is brought about by paralyzing the terminal sensory nerve-loops by swift movements. The therapeutic value of rapid interruption rests upon our ability to employ strong, efficient currents without discomfort, and is found in the nerve-quieting sedative effects of this interruption with fine coil currents.

Muscular effects are best attained by slow interruptions —interruptions sufficiently slow as not to overtire the muscle. This slow interrupted current is obtained by working the screw which withdraws the hammer attached to the platinum spring.

The faradic current has much more marked effect in producing muscular contractions than has the galvanic, but does not possess the chemical or electrolytic action. In the treatment of paralyzed muscles the faradic current is a more powerful agent than galvanism.

Tension and quality are the most important therapeutic factors of the faradic current.

Whenever you wish to produce sedation or muscular stimulation, you should employ the faradic current.

The current from the fine wire coil is of special use in allaying pain and establishing local anæsthesia. The relief afforded by the employment of the current from the long fine wire coil is just as certainly permanent as that afforded by opium or any other sedative, if the exciting causes which are active in giving rise to the pain and congestion are removed.

The pain, swelling, and venous distention of a contusion can often be quickly relieved by the primary current (*the* secondary would aggravate).

The pain of a cellulitis or other pelvic irritation will be relieved by the secondary current, while it would be aggravated by the primary current.

The faradic current produces a sort of interstitial massage, heightening the circulation, accelerating the process of absorption, and influencing favorably the nutrition of *the* parts.

The faradic current is used to improve the impaired nutrition of a paralyzed limb or limbs.

By the use of the faradic current the uterus and its appendages can be developed by causing a greater flow of blood to them. If the faradic current is directed *longitudinally* through the uterus, it promotes powerful and genuine uterine contractions; but if passed *transversely* through the organ it excites partial contractions only in the direction of the current.

Old adhesions, of long standing, between the uterus and its appendages can be broken up and the soreness removed by using well-selected interrupted currents. The first object is attained by the employment of the current from the short thick wire; and the second by the use of the current of tension.

Amenorrhœa, due to arrest from cold, getting the feet wet, etc., can be usually readily overcome by bipolar intra-uterine coarse wire faradic treatment. This line of treatment should rarely be resorted to in young girls for obvious reasons.

The secretion of milk may be much stimulated by faradization of the breasts with strong currents.

In neuralgia the *faradic* current is to be preferred where firm pressure relieves the pain or does not increase it, and the *galvanic* where the pain is increased upon pressure.

The faradic excites more acutely the cutaneous nerves, and penetrates more deeply into the tissues. It far surpasses any other form as a stimulant to the nerves of sensation.

All forms of electricity have a marked action upon the muscular fiber cells, but more especially so the induced current. Where the object is to obtain stimulation, faradism is the best form of current to use. The therapeutic effect of the faradic current is mainly due to the mechanical vibratory influence upon the molecular composition of the organism.

The faradic current is to be employed where tonic or stimulating effects are chiefly desired, and with this object it is valuable in the treatment of paralysis, of anæsthesia, or in conditions where the involuntary muscles require to be roused; thus the abdomen and the rectum may be faradized for constipation, and the bladder and the uterus for atonic conditions.

Faradization of the skin produces a pricking kind of pain, contraction of the muscular layer of the corium, and changes in the diameter of the blood-vessels. The effects are greater if the skin be dry than if it be moistened; for if it be moist, the largest portion of the electricity is led off into the deeper structures, while if it be dry, the resistance to its passage is very considerable, and the skin itself receives almost all the electricity.

In faradization of the skin, when employed for its reflex effects, the current should not be strong enough to excite muscular contractions.

The effect of faradization on the blood-vessels of the skin is to cause them to at first contract and afterward dilate. This can be well illustrated by applying the faradic brush to the skin. The skin at first becomes pale and anæmic, due to contraction of the arterioles, which is after a few moments succeeded by hyperæsthesia of the skin, owing to the enlargement of the vessels.

Faradization applied by large electrodes has less effect on the sentient nerves, and consequently causes less pain, than if conveyed by a small conductor. For faradizing muscles of a small surface, or fine nerve-fibers, either for clinical demonstration or for the purpose of diagnosis, small electrodes should be used for obtaining a decisive result.

The faradic current may be used as: (1) General Faradization, (2) Localized Faradization, (3) The Bipolar Method.

General Faradization.—Beard and Rockwell recommend the following method of applying the electric current in *general* faradization: The patient should stand or sit with both feet resting on the surface of a large metal electrode, to which the negative pole is attached. The other electrode, the positive, is then to be moved over the various parts of the body, two or three minutes being given to each of the more important regions. The treatment of the back and the whole region of the spine is considered to be extremely important and should be thoroughly carried out, the electrode being slowly moved up and down along the whole length of the back. The most thorough form of application requires that the entire surface of the body should be gone over with some regard to order. Special pains should be taken to avoid the scapulæ, clavicle, ulna, sternum, crest of the ilium, and tibia, inasmuch as these and other bony prominences are very sensitive to the electric current. (Severe pain is caused by the current acting on the nerves of the periosteum, therefore the placing of an electrode on the surface of a bone should be avoided as much as possible.) The object of this method of treatment is to bring every portion of the body, in turn, under the influence of the faradic current, so far as is possible by external applications.

General faradization is especially suitable for cases where a general tonic effect is desired, as in constitutional debility, but more especially in nerve-exhaustion. It is called for in those nervous affections accompanied by loss of body weight, and by muscular flabbiness and feebleness. It is a valuable agent in the treatment of dyspepsia, rheumatism, amenorrhœa, chorea, constitutional anæmia, and other diseases associated with deficient vital energy. General faradization should not be used in cases threatened with paralysis or apoplexy, or those in which a recent attack has occurred.

After a course of treatment by this method the appetite is increased, the patient sleeps more soundly, there is an increase in the firmness of the muscles, or an improvement in the general condition of the system.

In applying general faradization (as in all other forms of electricity) it is best to begin with a very mild current, and then increase or diminish according to the sensations of the patient; always bearing in mind that certain individuals are more susceptible to the influences of electricity than others, and as soon as the sensation produced becomes unpleasant the power of the current should be diminished. The sensations felt by the patient should be of an agreeable nature, a pleasant thrill, without any sort of pain or discomfort. The duration of a treatment should be, on an average, about fifteen minutes. The frequency of a treatment will vary in different cases, but, as a rule, they should be given twice a week until twelve or fifteen have been given, and then once a week till five or six more have been given. Many cases will not require so many, while others will require more.

Localized Faradization.—Localized faradization is applied by placing one pole direct to the part to be affected and the other on some indifferent point.

Duchenne proposed two different methods of faradizing the muscles: by localizing the faradic stimulus in the nervous plexuses or branches, which communicate their excitation to the muscles animated by them (indirect muscular faradization); and by directing the current to the muscular tissue itself (direct muscular faradization).

Localized faradization is called for in all kinds of paralysis; also in certain forms of dyspepsia, rheumatism, and lumbago; as a stimulant in cases of constipation, and as a sedative in neuralgias, especially when the fine coil or tension current is used, for the longer and finer the wire the greater is its power for relieving pain; also cases of hysterical hyperæsthesia, when slight pressure increases distress, while firm and prolonged pressure lessens it, are relieved by faradism, the galvanic current having very little effect over them.

Bipolar Method.—The bipolar method is the localization of the current by the means of single electrode carrying both poles, and is practically the application of localized electricity to internal organs—being used chiefly in uterine and pelvic diseases. (Engelmann.) Currents of quality for muscle effects, and currents of tension as nerve-stimulant or sedative. can both be used to advantage and without causing pain.

The advantage claimed by Apostoli for the bipolar method in internal applications are: (1) That it is more simple, requiring no assistant; (2) that it is less painful, the sensitive skin being avoided; (3) that it is more active, as localizing the full effect of the current used upon one small point; (4) that it is more efficient, as it admits of the use of stronger currents by reason of the lessened sensibility.

The conditions calling for bipolar faradization will be given when considering the electrical treatment for "Diseases of Women."

Galvano-Faradization.—In this method the battery is so arranged that the two currents (galvanic and faradic) may be utilized at the same time and through the same electrodes.

The "combined current" (galvano-faradic) is chiefly of service in overcoming the trophic disturbances which manifest themselves in connection with motor paralysis.

Static Electricity.

(*Franklinism.*)

Static comes from the Latin word *sto*—to stand. It was so called because it was thought that this form of electricity stood still on any insulated surface. This form of electricity is also known as "franklinism," so called in honor of Benjamin Franklin, one of the earliest to thoroughly investigate and to give prominence to it; also termed "frictional," because produced by friction.

The charge has been brought against static electricity that it resides upon the surface of charged bodies, that its influence is superficial, and that it cannot affect deeper parts. Professor Morton * has pointed out that not only is this statement disproven by actual experiment, but that it is untenable in the light of electro-therapeutics; that static electricity, when put to medical use, becomes kinetic (dynamic or current) electricity. Its strain is dissipated along and within conductors (the human tissue for instance) with the same facility as currents having a different ratio of electromotive force or amperes.

There are many serious objections to the static machine—namely, its expense, its size, and the care that has to be bestowed upon it; but all these objections are overbalanced by the great benefit derived from a judicious use of its current. Owing to its size, it is an instrument that can only be made use of in office practice. A machine to be of any therapeutical use must be able to generate a spark not only of length but also of quantity. The small machines are practically of little benefit in the treatment of disease.

One disadvantage of the large machines is that they lose their charge in damp weather, especially during the spring and summer months. Glass has a great power of condensing a thin film of moisture on the surface, and this film of water has conducting power enough to discharge any charged conductor. This tendency of the plates to lose their charge may be partially obviated by so placing the machine that the sun will shine upon the glass plates at least for a portion of the day; also by placing chloride of calcium (not the chloride of lime, for that will ruin the battery) in small dishes within the case, and as soon as sufficient fluid appears in the bottom of the dish to become perceptible, it should be removed. Calcium chloride possesses the property of depriving the air within the case of its moisture. During the winter months it is not absolutely necessary to keep calcium chloride in the case, but usually it is better to do so. By placing the solution and the moist lumps of calcium chloride in a metal pan in an oven and baking it, it can be used again.

* "International System of Electro-Therapeutics."

Another measure for drying out the battery is to place within the case a small gas burner; but great care will have to be exercised in using this, on account of the danger of overheating the glass plates and thereby rendering them liable to crack easily.

If the battery has lost its charge, it may be regained by heating a catskin, and, immediately on the battery being set in motion, applying the catskin to the plate which has the buttons on, as close above the comb as it is possible to hold it. This rarely fails to elicit a charge. But the easiest and most convenient method of obtaining a charge, and one that rarely fails, is to use a small Wimshurst machine. This can be set on top of the large battery and its poles connected to those of the larger by means of chains. After the large battery is set in motion, a

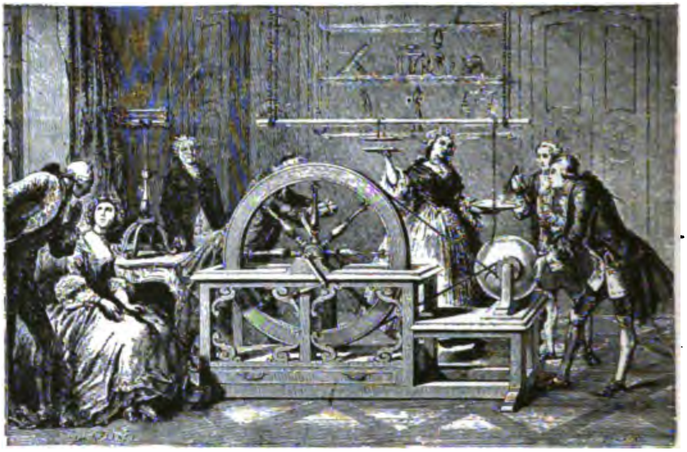

FIG. 91.—THE FIRST STATIC ELECTRICAL MACHINE. A ball of sulphur was cast and mounted upon a revolving axis in a wooden frame and excited by an application of the hands; the assistant so doing becoming the conductor for the positive current to escape. This primitive affair gave feeble sparks, which could only be seen in total darkness. Hawksbee later substituted a globe of glass for the ball of sulphur and collected the positive electricity upon a conductor suspended by silken cords from the ceiling, thereby obtaining more satisfactory sparks with the positive electricity thus generated.

few turns of the wheels of the small battery will immediately charge the plates of the large battery. A small Wimshurst battery seldom, if ever, fails to pick up a charge, no matter what kind of weather prevails. Some of the later machines have a small charger within the case (Fig. 92), which is attached by means of a switch to the belt which turns the large plates,

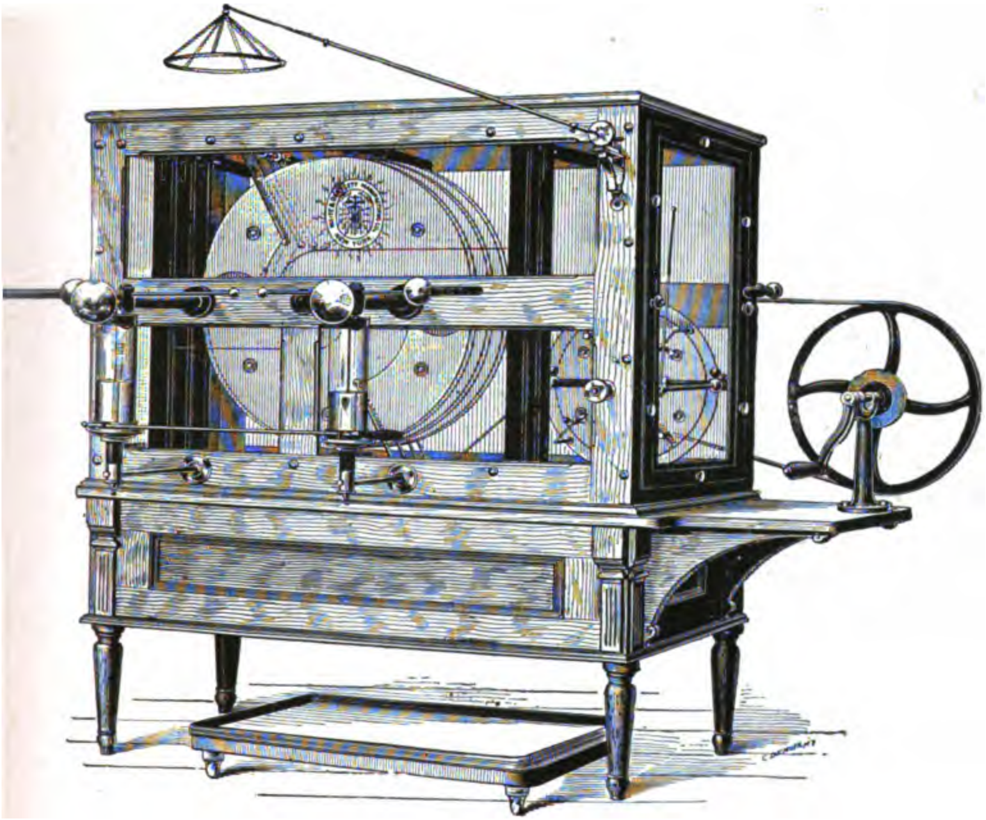

FIG. 92.—THE LATEST, THE RANNEY PERFECTED STATIC MACHINE. This machine contains within its case a small Wimshurst charger. When the large machine loses its charge (which occurs so frequently in warm, humid weather), it can quickly be restored by a few turns of the wheel, setting the small charger in motion, thereby saving the trouble of opening the doors of the battery and drying the plates or obtaining a charge by friction on the plates with the catskin.

and when the large plates lose their charge it is soon restored by setting the small machine in motion.

Often on a damp day it will be difficult to obtain a strong charge of electricity if the rod is allowed simply to rest upon the surface of the platform; but by having the patient hold the rod in the hand, or resting the feet upon a metallic plate or chain connected with the rod, a strong charge can be obtained.

Occasionally during the summer months, when the weather is hot and close, and the air is filled with moisture, it will be impossible to get a spark more than an inch long, for the reason that the atmosphere has become a good conductor and the current is induced into the air. Within an hour or two of that time a spark six or eight inches long may be obtained easily, owing to the changes that have taken place in the atmosphere during that time.

To test the polarity: If the machine be set in motion and the poles be brought near together, a light of a violet or reddish hue appears at the point of the positive pole (due to incandescent nitrogen); while at the negative pole there appears a brilliant white light (arising from incandescent oxygen); or, again, if the poles are brought together and the machine set in motion, if then the poles are slowly separated beyond the sparking distance, there appears a luminous appearance extending out from the positive pole, resembling in form a fox or a squirrel tail.

When the machine is in motion a peculiar smell is perceived, which is half sulphurous and half phosphoric, and is due to the transformation of the oxygen of the atmosphere into "ozone." The smell of ozone is perceived at both poles of the machine, but more strongly at the negative pole. This smell pervades rapidly through the air, so that often when the machine has only acted for a few moments a large room is completely filled with the smell of ozone.*

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* The peculiar smell which accompanies a flash of lightning is due to the transformation of atmospheric oxygen into ozone. The change in the atmosphere after a thunderstorm, which we so often speak of as "so fresh," "so exhilarating," is due to the development of ozone on a large scale. Ozone is one of the most powerful oxidiz-

This gas may be effectively administered to the patient by means of a paper cone, through the base of which the two poles pass. Care has to be observed not to come within sparking distance of the poles; also not to inhale too great a quantity of the ozone at a single sitting, as it is liable to produce severe vertigo. Ozone is of great service in treating anæmia, asthma, and especially in the treatment of the earlier stages of pulmonary tuberculosis.

Of late years *static* electricity has come more and more into use; and in a great measure has superseded the galvanic and faradic currents in the treatment of nervous affections. It has the advantage that it can be applied to all parts of the body without the necessity of removing or disarranging the clothing—an impossibility with the other forms of electricity.

The static current occupies a field peculiarly its own, in which it is unique. It is an ally rather than a competitor of other forms of electricity.

Static electricity is of far greater value than faradism, and at least as useful, if not more so, than galvanism.

When galvanism and faradism have either given negative results or have lost apparently for a time their remedial power when their use has been too long continued, the static form will often be found to possess a decided advantage, and will greatly aid us in accelerating results.

The static electrical machine is now used to procure all of the nerve and muscular effects hitherto obtained by faradic electricity, and also therapeutical results of a very striking kind of its own.

Static electricity may increase, diminish, arrest, or otherwise modify the ordinary vital processes without causing electrolytic alterations.

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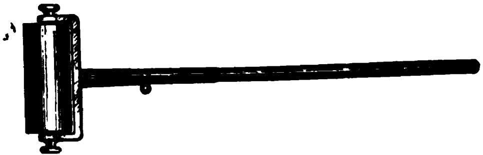
ing agents that we have. It purifies water which is charged with organic refuse and destroys the foul odors of the air. A small quantity of ozone is always contained in the atmosphere, but it varies considerably according to the season of the year. If it was not for the all-powerful purifying property of ozone, by which the air is constantly deprived of its noxious admixtures, life could not be maintained. Milk is soured during a thunderstorm by the chemical action of lightning—a consequence of an excessive generation of ozone.

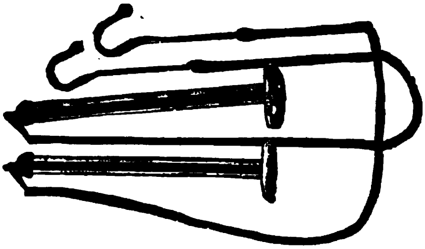
It is the great dispenser of equilibrium to the disturbed balance of the system; it increases the vital forces and augments the energy of absorption.

Static electricity is a powerful tonic, having the two-fold action of a *stimulant* and a *sedative,* according to the pole used.



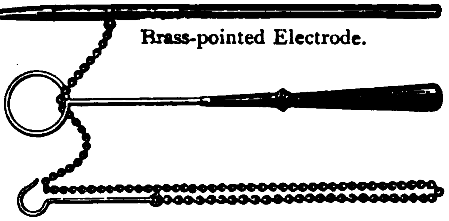
Massage Roller.

Rubifacient.



Handles and Sponges.

Brass-pointed Electrode.



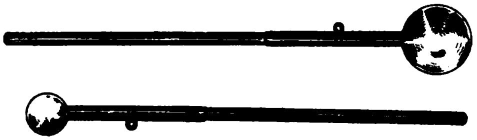
Chain-holder and Chain.

Fig. 93.—Showing Electrodes Employed in Giving Static Electricity.

Static electricity is unquestionably a powerful stimulant to processes of nutrition, and favors the restoration of healthy nutrition in tissues whose vitality has become impaired.

It is our most valuable agent in the treatment of that class of ailments known as "functional nervous diseases," such as epilepsy, hysteria, chorea, nervous exhaustion, spinal irritation, etc. The various forms of headache and backache will receive great benefit from this form of electricity; also chronic rheumatism, neuralgia, sciatica, paralysis, and general weakness.

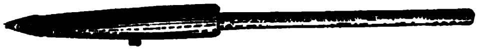
In anæsthesia, hyperæsthesia, and spasm static electricity acts by modifying the conditions of the sentient nerves of the part submitted to its influence.



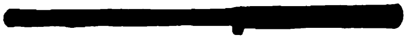
Brass Balls.

Brass Brush.

Wood Ball.



Wood Point.



Carbon Electrode.

FIG. 94.—SHOWING ELECTRODES EMPLOYED IN GIVING STATIC ELECTRICITY.

Without doubt static electricity is the ideal cutaneous stimulant. As a rule, it surpasses all other forms of electricity in the treatment of stiffened, contracted, or paralytic muscles, acute or chronic muscular deformities, and muscular spasm.

Ofttimes where no muscular contractions can be obtained in paralyzed muscles by faradism (the galvanic current giving contraction with the anodal closure, thus indicating reaction of degeneration), contraction can be obtained by means of the static current.

Static electricity is of great utility in inducing muscular contractions, and is generally less painful than the strong faradic or galvanic shocks.

It is more powerful than faradism in rousing the dormant nerve-centers.

It is a valuable agent in the treatment of motor-paralysis, and frequently restores the motor power of the muscles after all other measures have failed. In fact, muscles that have entirely lost their contractility may have it restored to them by this agent.

It relieves cutaneous anæsethesia more quickly than either galvanism or faradism.

Neuralgias and obstinate headaches usually receive more benefit from this form of electricity than from any other treatment.

It usually surpasses all other forms of electricity in dealing with cramps, rigidities, and wasting of muscles.

Static electricity possesses a decided advantage in some cases where faradization or galvanization have either given negative results or have apparently lost their remedial power after their use has been too long continued.

Static electricity, when properly applied, is one of the most powerful stimulants to the nervous system. Its tonic action makes it a valuable agent in diseases of the heart, both functional and organic. It cures certain diseases by changing the electrical condition of the patient, which may be rendered positive or negative at will.

Static electricity, by equalizing the nervo-electric force of the system, causes unhealthy action to be changed to healthy; and thus health may be restored.

It acts to agitate and change the nutrition of the tissue—is a powerful alterative.

Static electricity has been found to have a specific effect on metabolism, increasing it more than is done either by the galvanic or faradic currents.

Both in pulse and temperature, static electricity produces an equilibrium; that is, if the pulse is below normal, a static treatment will raise it up to normal; or, if above normal, it will reduce. The same is true of the temperature.

It makes more active the urinary secretion, disperses nervous irritation, and gives tone to the whole organism.

In all vasomotor disturbances, functional cerebro-spinal diseases, or neuroses, there is nothing which equals in value the diffuse and the concentrated constant high potential current from electro-static induction machines.

It quickens the circulation and promotes the glandular secretions and insensible perspiration; metabolism is promoted, appetite and digestion are improved, circulation and nutrition are benefited, sleep is notably restored, and nerve-vigor is imparted to the mental and physical faculties.

One of the most important points in the use of static electricity is the necessity for caution in order to avoid giving too large a dose. The great test for the dose of electricity to be given in any case is the nerves, and the best indication of their condition is the sleep. If the patient sleeps well every night, it is a pretty good indication that the dose he is receiving, even if a large one, is not causing irritation of the general nervous system.

The different effects that can be produced, according as the spark, the douche, or breeze, or simple insulation is employed, render it a very valuable agent. It can be even converted into the dynamic variety with effects similar to that of the faradic current.

Methods of Application of Static Electricity.

There are several different modes or forms of applying static electricity to a patient, and each form has its special indications.

The methods are: Static insulation or the static "electric bath"; static sparks; shocks with Leyden jar discharge; direct statical head breeze; static massage; and the static induced current.

Static Insulation, or the Static " Electric Bath."

In this form of application the patient sits upon a stool, which in turn rests upon an insulated platform. One pole of the machine is attached to the platform, while the other is grounded by a chain running to the floor, a water-pipe, or a gas-fixture.

The poles of the machine are separated as widely as possible before the battery is set in motion. The patient is charged positively or negatively, according to whichever pole he is connected with. The current flows gently and silently into the patient, saturating the whole system and escaping into the air from the various prominent points of the body. The escaping of the electricity is particularly noticeable in reference to the hair; every hair, providing it is not damp or oiled, standing straight out from the head. If the electric bath be given in a dark room, luminous appearances are produced by this escape of electricity into the air, especially about the hair. Complete electrification is shown by the loose hairs on the patient's head, which stand tensely out in all directions.

This " bath " of static electricity, when the positive pole is attached, is a most powerful stimulating tonic, and, when attached to the negative pole, a sedative tonic.

During an electro-positive bath the whole surface of a patient's body becomes charged with positive electricity, while the air surrounding it is rendered negative; thus, by changing the electric condition of the body, the patient's general conditions are improved, and many diseases are cured.

The state of the electrification of human beings in normal health is almost invariably found to be positive; hence the beneficial results of positive static insulation.

The static bath increases the metabolic exchanges, causing an increase in the amount of oxygen consumed, as evidenced by the increased pulse, the elevation of temperature (sometimes a degree or more), and the increase of urea excreted. During the treatment the secretions, especially perspiration, become more active; the skin, if the administration is long continued, breaking out in a mild perspiration.

This form is the most agreeable of all the methods of static treatment, is absolutely free from shock or disagreeable sensation, and is adapted to the most sensitive and delicate conditions. Immediately upon the battery being set in motion, the patient's hair begins to rise, and in a few moments a very pleasing sensation is felt through the system. Patients, after being electricized in this manner, often describe a sense of increased energy and a sense of exhilaration. The static bath has the great convenience that it does not require the removal of the clothing, as does the water bath.

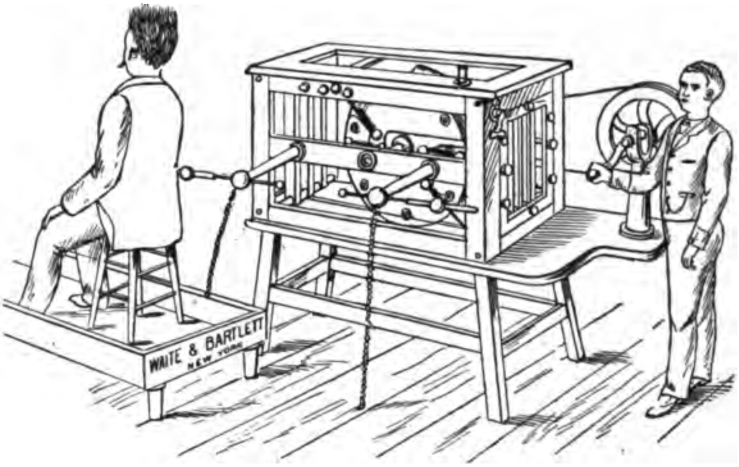


FIG. 95.—STATIC INSULATION.

The conditions calling for "positive" or "negative" insulation are best studied with reference to cases No. 1 and No. 2 in the diagrams which follow. The first column gives the morbid conditions from which the patients are suffering; the second column gives the special method of applying static electricity to each set of conditions.

CASE I.	Congestive headaches. Insomnia. Cold extremities. Nervous excitability.	Negative insulation, 10 minutes. Positive head breeze, 5 minutes. Positive spinal breeze, 5 minutes.
CASE II.	Anæmic headaches. General anæmia. General muscular weakness. Nervous exhaustion.	Positive insulation, 10 minutes. Negative head breeze, 5 minutes. Negative spinal breeze, 5 minutes.

Static insulation is one of the best general tonics we possess, and as such is easy and agreeable of application, and can be used in a great variety of cases.

When applied with the positive pole, it is a refreshing, grateful, and most agreeable tonic in all debilitated or negative states of the system—those neurasthenic, anæmic, malarious, cachectic conditions in which the patient is "below par."

For the aftereffects of the "grip," for brain fag of professional men, for physical, mental, and nervous exhaustion, it is in the nature of a specific.

Static electrification possesses nutritive and tonic properties of a high order, and in certain conditions one may even succeed in obtaining results after unsuccessful attempts with dynamic electricity.

Static insulation is especially useful in the treatment of "incipient insanity," on account of its great power to strengthen and tone up the depressed nervous system.

Its great fields are nervous and functional conditions.

As a general tonic, and also as a stimulant to depressed nervous functions, "static insulation" will surpass any other form of electrical application. In fact, static insulation is the base of all treatment by static electricity.

Far oftener, however, this treatment is passed by and the more severe methods employed. Too often the doctor is desirous of using that form of current (sparks) which makes the greatest impression (sometimes a very painful one) upon the patient, thereby losing the beneficial effects of the treatment. On this point Dr. Caldwell* voices what should be the sentiment of every static electro-therapeutist where he says: "In its application to disease, much has been written of the 'static spark' shock, or more severe form of its application, and many fall into the error of believing that, in order to get a pronounced physiological effect, treatment must be severe. If a little is good, more must be better. While in a certain class of diseases the severer methods are both useful and necessary, in others they are entirely needless."

In giving a static insulation care must be taken that the patient is well insulated, for if the patient is not well insulated there is a great waste of electricity, and the patient will not receive the full benefit of the "bath." The most perfect insulation is obtained by using a platform of glass having glass supports about twelve inches in length.

Static Sparks.

When the patient sits on an insulated platform, if a brass ball electrode connected to the other pole or to the earth, provided the current is grounded, is brought near the patient, a disruptive discharge ensues, accompanied by a spark. This then converts static into current electricity.

The duration of the whole spark has been estimated to be all over in the hundred-thousandth of a second. These sparks produce a pricking sensation, and at the points touched slightly raised spots with congested areola, similar to flea-bites, are produced. This eruption generally disappears within an hour or so. Sparks are taken from a patient in two ways, called the *direct* and *indirect* method.

THE DIRECT SPARKS.—In this method the patient is placed on an insulated platform, and connected with one pole of the machine (positive or negative, according as to whether positive or negative insulation is desired) by means of a chain or brass rod. A chain connected to the other pole is attached to a brass ball electrode, which is brought near the part to which the spark is to be applied or drawn from. The length and strength of the spark is regulated by the distance which the two poles are separated.

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* "Static Electricity as a Therapeutic Agent," by Frank E. Caldwell. M. D., Brooklyn, N. Y.

The Indirect Sparks.—In this method the patient is seated upon an insulated platform, which is connected to one of the poles of the machine by means of a chain or rod; to the other pole of the machine is attached a chain, which is grounded by being connected with gas or water-pipes. An electrode (ball, roller, etc.) is connected to a chain, which is either thrown on the floor or connected with the gas chandelier (providing that the current has been grounded by means of a water-pipe), and when the patient is charged, the electrode is brought near him, and a spark is immediately seen to pass between the two. The length and strength of the sparks are regulated by the distance which the poles are separated.

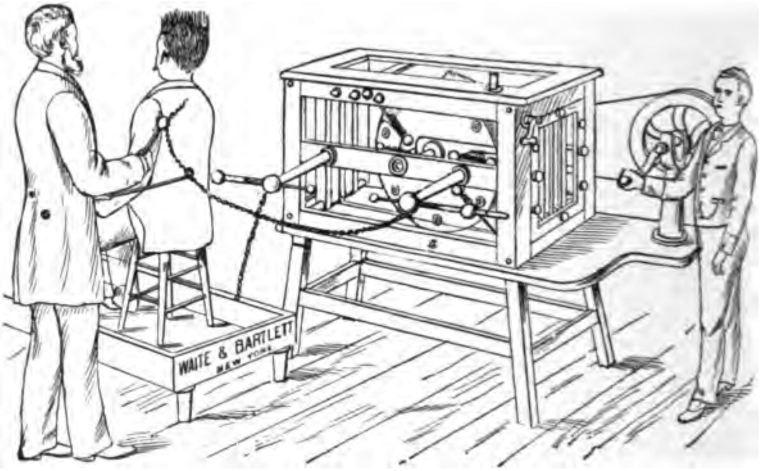


Fig. 96.—The Direct Static Spark.

Sparks administered by the indirect method are not so severe as by the direct method. When using either the direct or indirect sparks, if a mild form of treatment is desired, or if the treatment is about the head, a wooden ball electrode should be employed.

In using static sparks one has to be careful with very sensitive patients not to begin too violently. Very sensitive patients often respond badly to static electricity when given very strong, and for this reason it is often best with them to begin with a mild galvanic current, and later change to the static electricity.

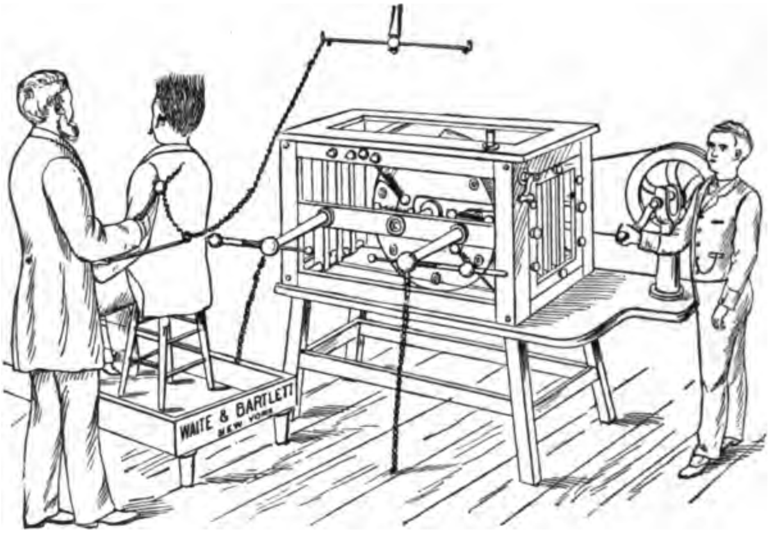


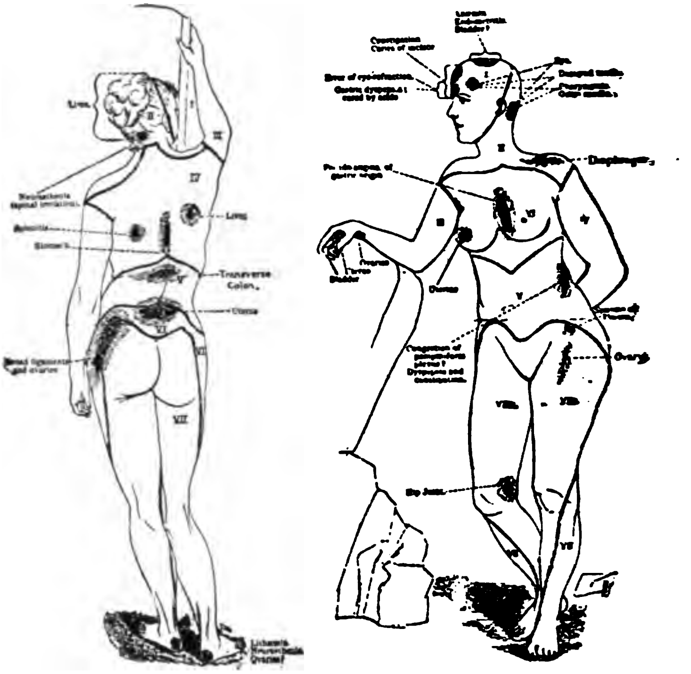
FIG. 97.—THE INDIRECT STATIC SPARK.

Care should be taken not to hold the electrode over one region too long, for a number of sparks upon the same spot is apt to create a tenderness.

Before applying the sparks it is better to have the patient remove his watch, and lay aside keys, eye-glasses, etc., for they will attract the sparks and produce too sharp a sensation for comfort in some cases. The same precautions will have to be observed when administering sparks to ladies who have on their wearing apparel steel buckles, metal buttons, etc. Some fabrics facilitate the application of sparks more than others.

In applying sparks upon the skin, it may be dried perfectly, if desired, by first dusting it with a little powder. The spark is then thicker, cleaner, and less sharp.

A long, thin spark is usually stinging, while a thick one is less so. If a spark "splits" and gives off fragments, seek the cause and correct it, for such a spark produces an uncomfortable sensation.



FIGS. 98 AND 99.—DIAGRAM SHOWING THE DISTRIBUTION OF THE CEREBRO-SPINAL STRANDS OF NERVES AND THE LOCATION OF TRANSFERRED PAINS. (After Dana.)

Strands of Cerebro-Spinal Nerves.	*Distribution.*
Area I....Trigeminus, facial, etc.	Face and its orifices, anterior scalp.
Area II....Upper four cervical.	Occipital region, neck.
Area III....Lower four cervical and first dorsal.	Upper extremities.
Area IV....Upper six dorsal.	Thoracic wall.
Area V....Lower six dorsal except the last.	Abdominal wall, upper lumbar, upper lateral thigh surface.
Area VI....Twelfth dorsal, four lumbar.	Lumbar region, upper gluteal, anterior and inner thigh and knee.
Area VII....Fifth lumbar and five sacral.	Lower gluteal, posterior thigh, leg.

The spark, by its powerful mechanical disturbance, sets up a great molecular change and acts as a stimulating massage. It thus affects the nutrition of a part, disperses exudated material, and promotes absorption.

The static spark of either form excites powerful muscular contractions, and, through its action upon the peripheral nerves, produces nutritive changes, not only in the organ to which it is applied, but, by reflex action, through the whole system. Torpid liver, gastralgia, dyspepsia, and constipation have been relieved by drawing sparks from over the affected organs, the action being reflex.

By means of the sparks the internal organs can be influenced reflexly through stimulation of the external peripheral nerves. Every internal organ has an area of skin-innervation which represents it externally, and by applying sparks to this external area the internal organ which it represents is affected.

The principal regions are: the region of the lower angle of the right scapulæ, in disease of the liver; a similar area in relation to the left scapulæ, in disease of the spleen; the distinct backache and pain across the lower part of the lumbar region, in disease of the uterus or its appendages and in constipation.

No matter how far from the local irritation a reflected pain may manifest itself, apply the sparks to the sore place and the impression will track the pain to its seat and drive it out.

The effects which peripheral stimulation exerts upon the central organs play an important part in electrical treatment, and afford the best explanation of the benefit which follows even in cases where the treatment has been applied to the peripheral parts only.

In its reflex action it has proven to be strongly tonic, not only to the nerve itself, but to the whole system as well.

By withdrawal of sparks from the various organs of the body, tonic and invigorating effects are obtained in cases of neurasthenia, exhaustion, and debility from various causes.

Static sparks surpass all other forms of electricity in that painful and obstinate affection known as "lumbago." Often one application will be enough to cure it.

Remarkable cures are effected in anæsthesia, hyperæsthesia, and neuralgia by insulation and the withdrawal of sparks from the affected parts.

It is especially useful in the various forms of rheumatism, such as muscular rheumatism, gouty rheumatism, etc.

Pains, in whatever location found, are often dissipated after a few applications of the sparks.

The static spark is the most powerful stimulus to nerve and muscle function, and rapidly imparts tonicity, lightness, buoyancy, and firmness to soft, lax, and enfeebled muscular substance.

It has given the most brilliant results in the various forms of paralysis, and frequently restores complete muscular power after all other measures fail. In those obstinate cases of hysterical paralysis its results are often miraculous.

The application of static sparks to post-paralytic contractures and protracted tonic muscular spasms surpasses every other form of electrical application.

Thickening of joints, tendons, and muscles, local œdemas, effusions, etc., are reduced by strong, thick static sparks.

Anæsthesia, not only of general sensibility, but also of pain and temperature, is more rapidly improved by the static sparks than by either galvanic or faradic applications.

There is no agent or remedy that will so efficiently check the severe stabbing and lightning-like pains of locomotor ataxia as will static sparks.

In cord disease it affords relief from various forms of pain, even when the lesions are advanced beyond cure.

Static sparks applied to "boils" in their earlier stages is almost a specific in checking their further growth—the boil withering and drying up within thirty-six to forty-eight hours.

Sciatica often yields to it more readily and permanently than to any other form of treatment.

In chorea, sparks applied along the spine and to the limbs will give excellent and often brilliant results.

It is both a cutaneous sedative and counter-irritant, and makes a powerful peripheral impression of great value in neurasthenia.

Often during the summer months it will be impossible to obtain sparks from a patient who has been perspiring freely, owing to the fact that the moisture which fills the clothing conducts the current off before it reaches the body. When this condition exists, the difficulty can be overcome by removing the clothing and drying the skin, afterward laying over it a dry towel. Many times, however, by simply laying a dry towel, or preferably a chamois-skin, over the clothing, sparks can be readily obtained.

Shock with Leyden-Jar Discharge.

In this form of treatment a pair of Leyden jars are attached to the poles of the battery, the tin-foil of each being connected by means of a brass rod. One pole is connected with the insulated platform, and the other to the electrode to be used.

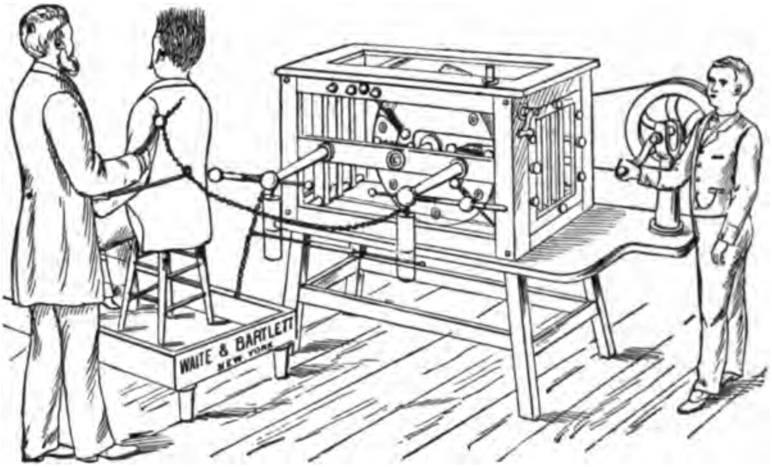


FIG. 100.—SHOCK WITH LEYDEN-JAR DISCHARGE.

Before setting the machine in motion, the poles should be brought together. In using this form of treatment, the sparks, as a rule, should be applied directly to the skin. These sparks produce a sharp, pungent sensation in the skin. The discharge of a Leyden jar through the body causes a peculiar stunning sensation, known as the "electric shock."

The Leyden jar sparks affect more profoundly the deeper tissues of the body than do the direct or indirect sparks. This form of treatment is especially useful in tuberculosis of the knee-joint, or, as it is commonly called, "white swelling." The joint is perceptibly diminished in size after two or three applications, and, if the treatment is persisted with, a radical cure will be obtained.

Static Breeze or Souffle.

This method of applying the static current consists in the withdrawal of the static charge from a patient by means of a pointed metal instrument or wood electrode, or of a blunt carbon electrode. There are two methods of application, termed "direct" and "indirect."

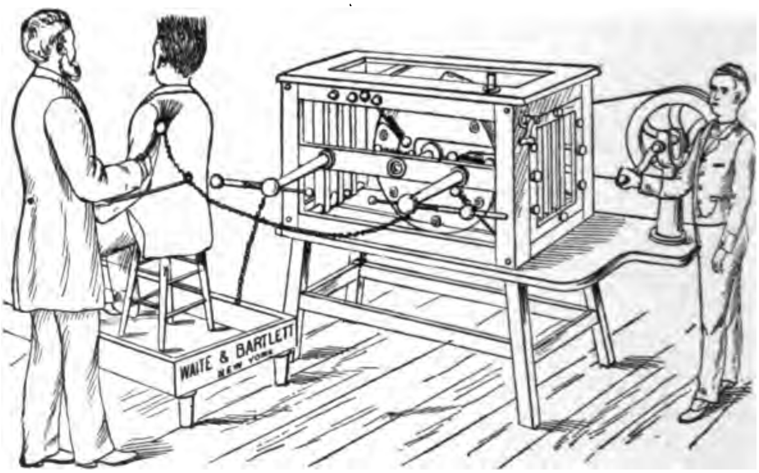


Fig. 101.—The Direct Static Breeze.

In the direct method the patient is seated upon an insulated platform, which is connected with one pole of the battery by means of a chain or rod, and an electrode (brass, wood, or carbon, as may be desired) is attached by means of a chain to the other pole.

In the indirect method the patient is placed upon an insulated platform, to which one pole is attached, the other pole being grounded by means of a chain attached to a gas-pipe or water-faucet.

Immediately after the battery is set in motion, the electrode is brought within five or six inches of that portion of the patient's body which we wish to be brought under the influence of the breeze. The patient feels a pleasant sensation, as of a cool draught of wind playing upon the part under treatment. Care should be exercised not to bring the electrode so near to the patient as to produce a spark or shock, which is not only disagreeable, but in some cases injurious.

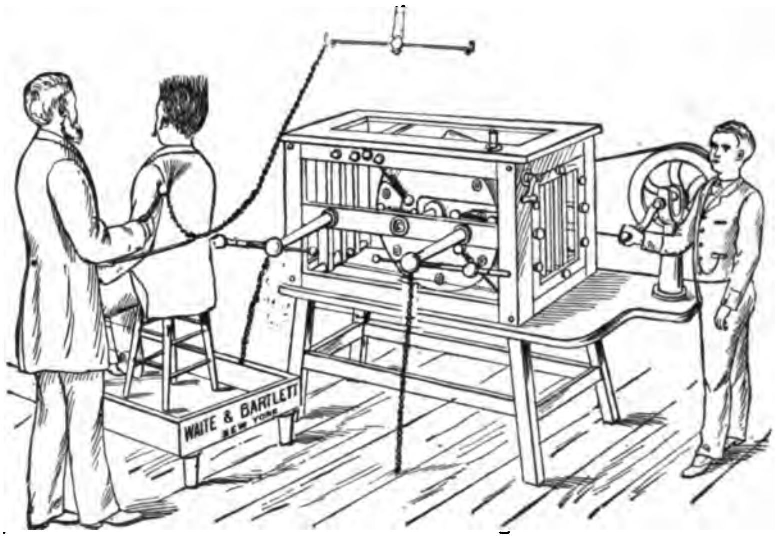


FIG. 102.—THE INDIRECT STATIC BREEZE.

In applying the breeze about the head, care will have to be taken where there are steel hair-pins; also where there are metallic ornaments about the neck; it is better in either case to have them removed.

In either the direct or indirect method, when the breeze is desired to be localized and powerful, the brass-pointed electrode should be used. When, however, a mild current is desired, or when the application is made about the head, and more especially about the eyes, a wood-pointed electrode should be used. "In warm or damp weather the carbon electrode will frequently be found to be more efficacious than either of the others." (Caldwell.)

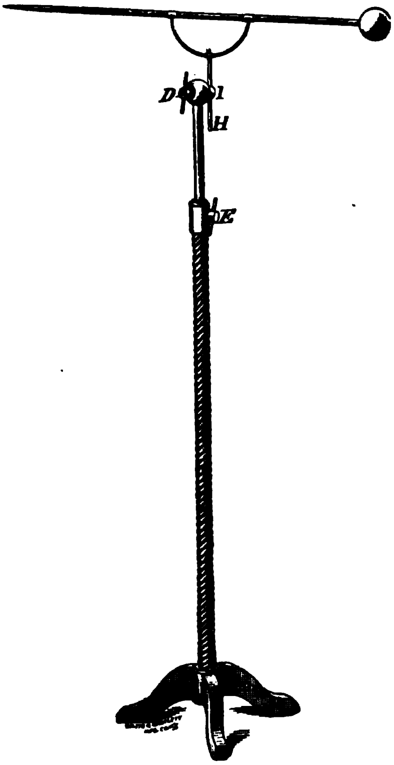


FIG. 103.—REPRESENTS A LONG-POINTED ELECTRODE FOR CONCENTRATING A STATIC BREEZE. To connect this instrument with the static machine, place it in slot *I* and fasten with screw *D*, by which you can deflect to any angle, and connect with one chain from *B* to *D*, the other from *B* to the platform or floor. To use, deflect the point of electrode to the part to be treated, the poles, *GG*, being pulled apart according to the strength required.

The breeze or souffle is used for the relief of pain, as headaches and the various forms of neuralgias; also for insomnia.

It is the most exquisitely delightful of all electric applications, and is hardly surpassed in importance by static sparks.

In administering the breeze it must be remembered that the positive pole is a sedative, and would be called for in *congestive* headaches; that the negative pole is stimulating, and would be indicated in *anæmic* headaches.

Direct Statical Head Breeze.

This method of applying static electricity is simply a modification of the direct breeze; instead of a sharp-pointed instrument being used, a metal crown with many points is used.

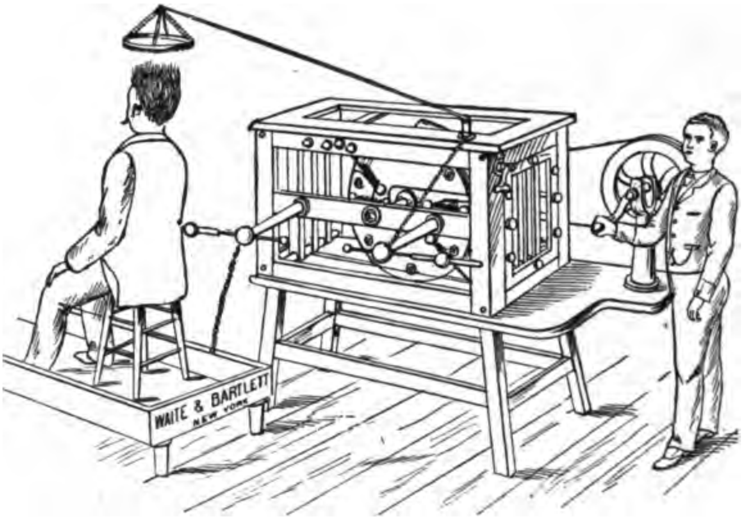


FIG. 104.—THE DIRECT STATICAL HEAD BREEZE OR HEAD-BATH.

In this application the patient sits upon an insulated platform, which is connected by means of a chain or rod to one of the poles of the battery, the other pole being attached by means of a chain to the brass crown, which is elevated five or six inches above the patient's head.

The electric head breeze, or "bath," can be made much stronger by having the patient hold the rod or chain in his bare hand. When the battery is put in motion, a pleasant sensation is felt permeating the hair and encircling the head. If, however, the breeze is concentrated at one point more than another, the patient will feel a prickling sensation, like fine needle-points, over the scalp.

In the static "head bath" the positive pole is sedative, and will be indicated in congestive headache, insomnia, etc.; the negative pole is stimulating, and will be called for in anæmic conditions.

Static Massage.

Static massage can be applied in two ways. Caldwell gives the following description: "(1) The patient is seated upon the insulated stool, which is attached to one pole of the battery, the brass roller attached by a chain to the other. The two poles of the battery are then brought near to each other

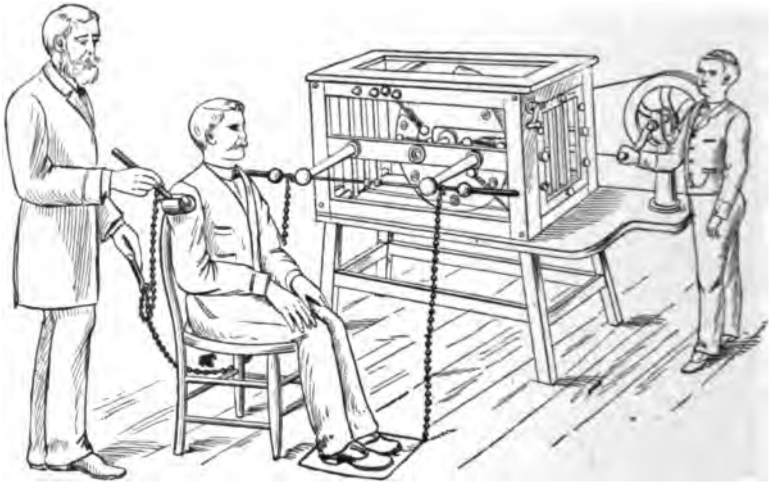


FIG. 105.—STATIC MASSAGE.

without contact. The battery being set in motion, the roller is passed over the arms, spine, and legs, the strength of the current being regulated by the position of the poles; the further apart they are, the stronger the current. (2) The patient may sit on an ordinary chair, with the feet resting upon a large square foot-electrode, connected with one pole of the battery. The massage roller, as in the first application, is attached to the other pole, and is passed over the extremities as well as the body of the patient." It thus produces a multitude of little sparks, whose length is measured by the thickness of the interposed fabrics.

In giving treatment with the roller it is always necessary that there should be an intervening cloth between the surface of the patient's body and the roller. The reason why friction can only be made over the clothing is, that if the roller were applied directly to the skin, there would be no insulation—the current would be conveyed directly to the earth. In giving the massage treatment the roller exercises a stimulating local action and a distant reflex action, whose effect, on the whole, is sedative; when applied over a large surface of the body, it is distinctly stimulating.

This form of application is especially useful in muscular rheumatism, lumbago, and sciatica, and when applied to the lower half of the body it diminishes over-excitability of the spinal centers, and is therefore especially useful in spasmodic states of the lower limbs, exaggerated reflexes, seminal emissions, etc. It is also especially useful in rheumatoid arthritis. It alleviates the pain, relieves the stiffness, and frequently reduces the swelling of that affection.

The Static Induced Current.

This method of applying the static current was first brought out by Professor J. W. Morton of New York, in 1881.

The static "induced" current is a current of great power and peculiar properties. Professor Morton says of it as follows: "It is, in reality, a current differing from any other current in use in medicine, owing to the continuation of the high frequency of its alternations or oscillations (millions per second) and its high electromotive force (several hundred thousand volts). It is essentially a high frequency, high potential current. No chemical decomposition attends its flow, but, in lieu of this, great muscular disturbance takes place. The resistance of the human body may be said to be almost nil, and all parts are easily and equally penetrated by it."

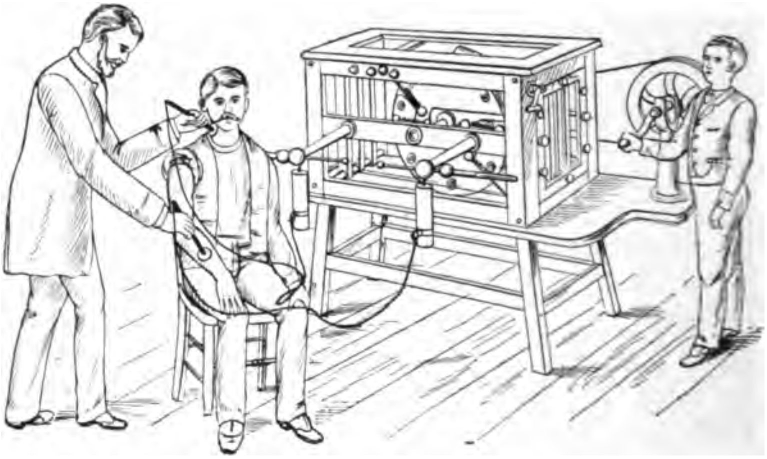


FIG. 106.—THE STATIC INDUCED CURRENT.

In this application it is not necessary to insulate the patient, the patient being seated on an ordinary chair. To each pole of the battery is hung a small Leyden jar, and to the outer coating of the jar an insulated cord is attached by means of a brass hook. The poles are brought closely together, but not directly in contact, and when the battery is put in motion they are gradually separated by a screw-like motion, care being taken not to separate them too abruptly or a sudden shock may be the result, which, to a nervous, sensitive patient, may be very painful. The strength of the current is regulated by the amount of separation of the poles; also by the size of the Leyden jars used.

The static induced current resembles in many respects the secondary faradic current, but differs from it in that it has a fixed polarity and direction; also it is more powerful and penetrating.

In the treatment of paralysis it will often prove of more benefit than either the faradic or galvanic current. It excites muscular contractions more readily than the faradic current, and with little or no pain; muscles will react when not the slightest reaction can be obtained from the strongest bearable application of the faradic.

It is a most powerful tonic to weakened muscles, and is especially useful in the treatment of paralysis in children, as it does not hurt or frighten them, which cannot be said of any faradic current, however skillfully applied.

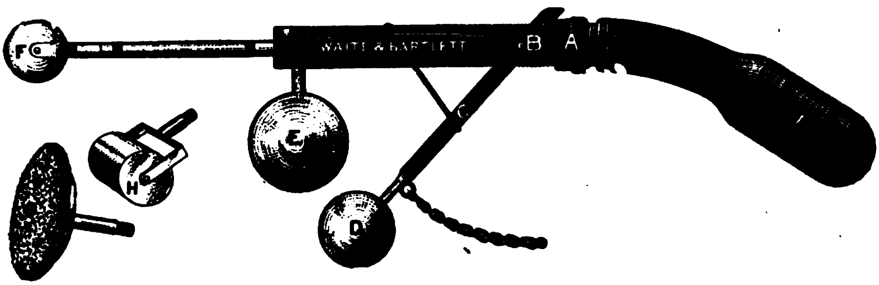


FIG. 107.—MORTON'S PISTOL ELECTRODE. This electrode is another means of converting static into dynamic or current electricity, thereby making a static battery perform the work of a faradic or induction battery.

Facial paralysis is a difficulty frequently occurring, and yields quickly to the static induced current when there is no organic change in the nerve. (Caldwell.)

The static induced current is especially applicable to diseases of the cord, on account of its great penetrating power.

In cases of general debility, muscular rheumatism, neurasthenia in all its various forms, and convalescence from various diseases it has proved a most valuable adjunct to medical care.

Sinusoidal or Rapidly Alternating Electric Current.

Within a few years much interest has been developed in a newly described form of an electric current, termed "sinusoidal" by D'Arsonval, by reason of the regularly sinusoidal form of the curve produced by the current when graphically represented. The current is obtained from a magneto-electrical apparatus.

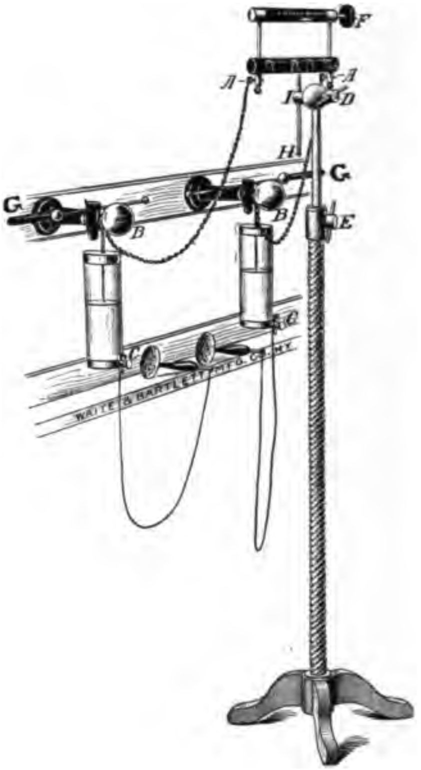


FIG. 108.—REPRESENTS A DEVICE FOR OBTAINING AND GOVERNING THE "INDUCED CURRENT," AS MODIFIED BY RANNEY. To connect this instrument with the static machine, place it in the slot *I* and fasten with screw *D*. The conducting chains connect from *AA* to the pole rods *BB*, just back of the pole end balls. To use, connect the sponge-covered electrodes to the binding posts, *CC*, on the brackets holding the Leyden jars, and govern the strength by the screw *F*. The pole-pieces, *GG*, on static machine, should be pulled from four to eight inches apart.

The chief characteristics of this current are its painlessness and its great penetrating power. It possesses the remarkable property of producing muscular contractions with very little, if any, pain, the only sensation being a slight pricking of the skin; this is due to the great penetrability of the current.

Dr. J. H. Kellogg says that with fourteen thousand to sixteen thousand alternations per minute he has observed a decided diminution in the sensibility of the parts to which the current was applied; so much so that in ten minutes the strength of the current could be doubled without producing increased sensation.

With oscillations sufficiently rapid (five hundred thousand to one million per second) currents of sufficient strength to light an incandescent lamp may be passed through the body without being felt, with the exception of a little heat being experienced at the points of entrance and exit of the currents from the body.

This current is a powerful stimulant to the metabolic processes of the body. D'Arsonval claims that by applying this current by means of a water bath, the respiratory circulation will be increased by about fifty per cent., with a corresponding increase of the urea and carbonic acid eliminated.

Drs. Gautier and Larat of Paris, France,* claim that any current having oscillations over twenty thousand per minute are sinusoidal currents, and that the action of the sinusoidal current is to increase the absorption of oxygen and the elimination of carbonic acid and urea. They claim that the current is useful in reducing obesity and in treating certain forms of eczema and vitiligo, and that it is peculiarly efficient in the treatment of infantile and pseudo-hypertrophic paralysis. They recommend that the current be applied through electrodes hanging over the edge of a porcelain bath.

**Journal of Electro-Therapeutics*, January, 1894.

Electric Diagnosis.

For diagnostic purposes both the faradic and galvanic currents are used. In making an electrical examination for diagnostic purposes the indifferent electrode should be of large size, in order to overcome the skin-resistance, and should be placed over a distant part of the body, as upon the sternum, or the sacrum, or the nape of the neck. Erb recommends the sternum as the best position for the indifferent electrode, because it is both symmetrical in position and is also further removed from the spinal nerve-trunks than any part of the surface of the back. The exciting electrode must be of small size, for the sake of localizing the current to the particular nerve of muscle to be tested.

For localizing the current in the smaller muscles, such as those of the face or hands, small conical electrodes should be used.

The electrodes should be covered with chamois-skin or sponge, and thoroughly moistened with a saline or soda solution. Care must be taken that the electrodes are in good contact with the skin; also that the exciting electrode is applied with uniform pressure.

The exciting electrode should have a key arranged conveniently in the handle for closing and opening the circuit. This electrode is termed an interrupting electrode.

When the faradic current is employed, it is of little consequence which pole is used, as the reaction of the nerve and muscle is the same in quality for both poles; the secondary spiral, however, acts with greater intensity, and is for this reason usually employed; but when using the galvanic current, the selection of the pole to which the testing electrode is attached is of the greatest importance. In the galvanic current the current always passes from the positive to the negative pole; hence, when the positive pole is placed on the breast or neck and the other on the muscle to be treated, we have a *descending* current, and an *ascending* current when the negative is placed on the head or neck and the positive on the muscle.

The faradic current is valuable diagnostically for determining the existence and increase or decrease of pathological excitability, in differentiating between central and peripheral lesions, and in the detection of simulation. To test the normal reactions of nerves and muscles, the galvanic current is the one used exclusively.

Electricity may be used to distinguish between apparent and real death. The thought of being buried alive is probably the most repulsive one which may present itself to the human mind. There is no doubt that numbers of persons have been buried alive, more especially during epidemics and after great battles. The signs of death commonly relied upon, such as holding a looking-glass to the mouth to detect moisture, dropping melted sealing-wax on the skin to cause reflex movements, cessation of the heart's action and of respiration, stiffening of the muscles (rigor mortis), the dull cornea, the dilated pupil, non-transparency of the fingers to lamp-light, etc., are occasionally doubtful of value, since all have been present in cases of trance.

In the faradic current we have an agent which will tell us positively within two or three hours, or at most six hours, whether life is or is not present. When the faradic contractility is gone, we may say with certainty that death has taken place. No disease, nor any kind of asphyxia or poisoning, will during life abolish the faradic contractility of all the muscles of the body. In real death the power of the faradic current to excite muscular contraction ceases within one-half to three hours; a few instances, however, are on record where it has remained even five or six hours. It disappears more rapidly after death from chronic than from acute diseases. An exception to this rule is met with in cases dying from cholera, where it has been found to be gone in thirty minutes after life has been extinct. The electro-muscular contractility remains longer in well-nourished than in wasted bodies. M. Crimotel of Paris says that in newborn infants muscular contractility, under the influence of the faradic current, continues fifty to sixty minutes after the heart has ceased to beat. When they have never exhibited the signs of life, the faradic test shows whether life is really extinct.

In apparent death (trance) the power of the faradic current to excite muscular contractions is never lost. Professor Rosenthal cites a case where the patient had been apparently dead for thirty-two hours; on applying the faradic current, all the muscles responded to the stimulus; whereupon he pronounced the patient not dead, but merely in a trance. The subsequent history of the case proved this diagnosis correct, for within twelve hours afterward she spontaneously awoke, recovered, and was alive two years afterward.

As a résumé of the above subject, we would give the following precept: *The loss or preservation of the farado-muscular excitability may be used for rendering perfectly certain the diagnosis between real death and apparent death or trance.*

Electricity may be used to differentiate between true and feigned disease. Persons may feign disease, especially paralysis and anæsthesia, for the purpose of exciting sympathy in order to obtain charity, to avoid duty, or for the purpose of obtaining damage after accidents. Some malingerers may have sufficient control over themselves to bear without flinching severe pain, as produced by pricking, pinching, or burning, but it would be absolutely impossible for them to resist the contractions of the muscles when the faradic current of high tension is applied; also faradization of the skin with the wire brush will often be sufficient to decide whether the patient is shamming or not. As a general rule, in cases of paralysis, if the muscles respond to the faradic current after the patient has complained for fourteen or eighteen days, it is one of imposition. In speaking of the value of electricity in making a diagnosis, Haynes says: " In those difficult cases after railway and other accidents, when persons demand compensation for damages, the existence of the reaction of degeneration would be a fact of vital importance in favor of the applicant, or it would indicate that he was suffering from a severe injury of the nerves. Such a demonstration in a court of justice is more conclusive than any amount of authoritative opinion."

Electricity may be used to differentiate between ovarian pains due to organic lesions and ovarian pains which are simply nervous in character. Make vaginal or intra-uterine faradization; if the pain disappears or is greatly relieved by it, it is not of an inflammatory origin, but simply nervous; but if after one or two applications the pain is not relieved, the diagnosis would be inflammation of the appendages.

The faradic current may be used to differentiate between central and peripheral paralysis. In paralysis due to central (cerebral) causes the muscles do not lose their faradic irritability; while in peripheral paralysis the faradic irritability slowly diminishes, and in fourteen days is lost. Electricity may be employed to detect the presence and location of the bullet in gunshot wounds.

SPECIAL ELECTRO-THERAPEUTICS.

The Application of Electricity to Special Organs or Parts and to Special Diseases.

Electrization of the Brain.—Formerly it was supposed that an electric current would not penetrate the brain-substance, but it has been demonstrated conclusively that the current, when applied to the head, traverses all portions of the brain equally.

The brain may be affected directly, by galvanizing the head and neck, or indirectly (reflexly), by stimulating the integument and the peripheral nerves. To galvanize the brain, one of three methods may be employed: (1) Place one electrode on the forehead, the other to the occiput. (2) Place one electrode to the left and the other to the right temple. (3) Place one electrode to the right and one to the left mastoid process. If, however, one hemisphere is to be galvanized, as in certain cases of hemiplegia, place one electrode over the eyebrow and the other in the hand of the same side. In case the patient is very sensitive to the use of electricity, Althaus advises that one electrode be placed at some distant part of the body, as the palm of the hand, the sternum, etc.; then use the indicated pole to the forehead, temples, or nape of the neck.

According to Löwenfeld, when the positive pole is placed on the forehead and the negative on the back of the neck (descending current), a contraction of the blood-vessels of the brain and its membranes occurs; by this arrangement of the poles the flow of the blood to the brain can be diminished. When the negative is placed on the forehead and the positive to the nape of the neck (ascending current), a dilatation of the vessels results; this method of applying the poles increases the flow of blood to the brain and accelerates the circulation. When the electrodes are placed on opposite sides of the head, a dilatation of the blood-vesssels lying beneath the positive pole is produced, and a contraction of the vessels in the side on which the negative pole is placed; therefore the positive pole is to be applied to the diseased side if the circulation of the brain is to be increased, and if it is to be diminished, the negative.

Less dizziness is caused if the current passes through one side of the head only, or from forehead to occiput, than when sent from one side to the other through the temples or mastoid processes. When applying electricity about the head, and the patient complains of dizziness, it is an indication that the current is too strong or that the sitting has been prolonged too long. Galvanization of the brain must be practiced with caution, especially in patients threatened with, or who have had a previous attack of, apoplexy.

All application of electricity to the head should be brief and made with a current of moderate strength. The sitting, when the stabile method is used, should not last over two or three minutes; when the labile method, the sitting may last four or five minutes. The strength of the current should be made to depend absolutely upon the sensitiveness of the individual to the current, always keeping in mind that some individuals are more easily affected than others. Great care should be exercised in turning the current on and off gradually, so as to avoid a shock.

In galvanism we have a valuable adjunct in the treatment of congestion of the brain. Various congestive states of the brain, which, if unchecked, would undoubtedly result in organic disease, may, by the use of this agent, be averted. In the application of the galvanic current to the brain to antagonize various congestive states, Dr. Mann advises placing the positive pole at the level of the superior ganglia of one of the cervical sympathetic nerves. The current should be interrupted, since vascular contractions occur most markedly at the opening and closing of the circuit.

When cerebral anæmia of a general character exists, general faradization, central galvanization, and static electricity by insulation are often of material benefit. Franklinic electricity, in the form of the static breeze applied to the head, is a powerful modifier of the intracranial circulation. In addition to the direct application of the galvanic current to the brain, much benefit can be obtained from general faradization and from the use of static electricity to the extremities. That the application of electricity to the peripheral nerves acts as a powerful reflex stimulant to the brain cannot be doubted. Nothnagel observed contraction of the cerebral blood-vessels following electrization of the skin and sensory nerves. Rumpf found that faradization of the skin of a limb caused transient anæmia, followed by congestion of the opposite hemisphere.

The faradic current passed in any direction through the brain produces at first anæmia, caused by a contraction of the blood-vessels of the brain, which is quickly followed by hyperæmia, due to paralysis of the blood-vessels.

For the electrical treatment of special disease of the brain see chapter on " Diseases of the Brain and Its Membranes."

Electrization of the Spinal Cord.—When the galvanic current is used, the spine should be thoroughly galvanized. To accomplish this the following method may be employed, according as to whether we want stimulating or sedative effects: The spinal cord is stimulated or excited by passing the negative pole up and down the spine, the positive pole being placed at some indifferent part of the body, as the sternum or the abdomen; the reverse of the poles produces sedation. The negative pole at the upper end of the cord and the positive at the lower end produces anæmia; while the reverse of the arrangement produces hyperæmia. The negative pole above and the positive pole below excites and increases the reflex excitability of the cord and the excitability of the reflexes.

Ranney is of the opinion that galvanic currents are of greater service in the treatment of spinal disease than faradic or perhaps the static—chiefly on account of the depth of the tissues affected and the chemical and molecular changes which galvanic currents tend to induce.

The cord may be affected reflexly by stimulation of the peripheral nerves by means of the faradic or static current. In some unexplained way the excitation of muscular action and stimulation of the cutaneous nerves exerts in many instances a remedial effect upon lesions of the spinal cord.

For electrical treatment of special diseases of the spinal cord see " Diseases of the Spinal Cord and Its Membranes."

The Stomach.—The morbid affections related to the stomach which frequently call for electrical treatment are dyspepsia, neuralgia, and vomiting.

DYSPEPSIA.—Electricity is of special benefit in the treatment of *atonic* and *irritative* dyspepsia.

Atonic dyspepsia is due to a general lowering of the vital powers—an exhausted condition of the nervous system. Leucorrhœa, menorrhagia, excessive sexual indulgence, mental or physical overwork, all tend to lower the vitality. It is not uncommon to find anæmia and indigestion closely allied.

Irritative dyspepsia is met with more frequently in those persons addicted to the use of alcoholic liquors or highly seasoned food, or in persons of a gluttonous habit.

In either variety of dyspepsia there is a deficiency in the quantity and quality of the gastric juice, and an abnormal increase of alkaline mucus which gives rise to fermentation instead of digestion. The stomach becomes distended with gas, so that peristalsis is impaired and there is an obstruction to absorption of the stomach contents. Moreover, the food becomes so enveloped in the alkaline mucus that the gastric juice fails to penetrate it and reach the food. As a result of this condition there is more or less flatulence, the tongue is more or less coated, the patient complains of more or less distention after eating, and sometimes of heartburn, water-brash, sour stomach, etc. These sensations (heartburn, sour stomach, etc.) are not due to an excess of the acid of the gastric juice, as is commonly supposed, for that is really diminished, but, as Dr. R. C. M. Page points out, to lactic and butyric acids formed from the starchy foods, instead of the latter being converted into glucose.

Associated with the above symptoms there are at times great dyspnœa and palpitation and irregular action of the heart, with intermittent pulse—in fact, dyspepsia is one of the most frequent causes of intermittent pulse. These symptoms (dyspnœa and irregular cardiac action) are due partly to pressure from the distended stomach, and partly to reflex action along the pneumogastric and phrenic nerves.

In the treatment of these cases, removing the cause and regulating the diet are of prime importance. Then, by the judicious use of electricity, remarkable results can often be obtained. The tendency of electricity is both to increase secretory processes and modify their quality.

No fixed rule can be given for the selection of the current that can be invariably followed. In the atonic type, the faradic current of rapid interruption and high tension yields superior results to the galvanic; also static insulation for ten minutes, followed by the spinal breeze for five minutes, will prove beneficial. " When the faradic current of high tension is employed, the electrode which is employed over the region of the stomach is kept in constant motion, so as to avoid those painful muscular contractions that so frequently occur." (Rockwell.) The other electrode may be placed either over the cervical or lumbar region. Dyspepsia dependent upon spinal exhaustion will be relieved by a mild galvanic current applied to the spine, one pole being located high up over the superior cervical vertebræ, the other over the end of the coccyx. In regard to the irritative type, Haynes says as follows: " Dyspepsia caused by overeating, indulgence in intoxicating liquors, or where poisons have been taken, is usually accompanied by a congested condition of the stomach. A mild faradic current applied over the region of the stomach will excite contraction of the blood-vessels and lessen this congestion."

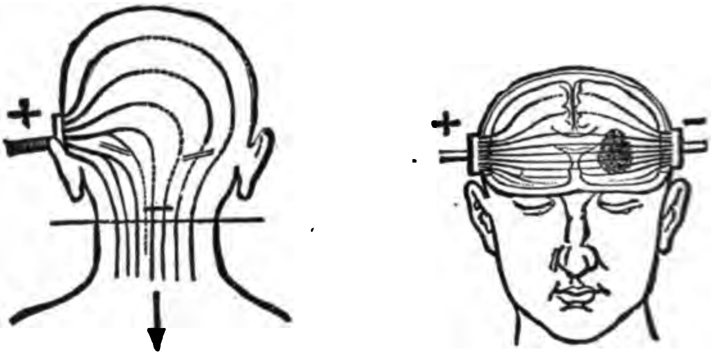


FIG. 109. FIG. 110.

FIGS. 109 AND 110.—A SCHEMATIC REPRESENTATION OF THE DISTRIBUTION OF AN ELECTRIC CURRENT APPLIED UNILATERALLY AND TRANSVERSLY THROUGH THE HEAD.

The application of static electricity will prove of great value in that form of dyspepsia known as " nervous dyspepsia." As a rule, the patient should be insulated with the positive pole (as the most of these cases are due to a general debility of both the physical and nervous systems), and mild sparks are applied over the region of the stomach and bowels. It has the effect of correcting any insufficient or perverted innervation of the stomach, and of regulating, first, the action of the glands of the stomach, and, second, the hydrochloric acid in the stomach, lessening it when the quantity is too great, and increasing it when the amount is too little.

VOMITING.—Obstinate vomiting from functional causes can often be promptly relieved by the judicious use of electricity. Both the faradic and the galvanic currents have been employed with beneficial results. When the faradic current is employed, place one pole over the pit of the stomach and the other over the lower dorsal region; when the galvanic current is used, place the negative pole over the pit of the stomach and the positive over the nape of the neck. If, however, the vomiting is due to an organic lesion, it will seldom, if ever, receive more than temporary benefit.

NEURALGIA.—Neuralgia of the stomach can be greatly benefited, and in the majority of cases relieved, by the use of the franklinic current in the form of electro-positive or electro-negative baths, combined with local treatment by drawing sparks from the painful region.

The Liver.—The liver is the largest gland of the body, and its function is an important one. It is a great physiological and chemical storehouse and a center for chemical changes upon which nutrition largely depends. It makes and stores up the glycogen which is to be called into play when heat and muscular energy is required. It secretes the bile and doles it out when it is required to carry on digestion. It destroys the peptones which are poisonous, and, in its conservative way, turns them into glycogen. It carries off other organic poisons which have been formed in the alimentary canal during digestion, and which have been introduced into the system from without. In fact, it is one of the most important scavengers of the body.

When the functions of this great organ are deranged, the following symptoms are present: Headache, a thickly coated tongue, a bitter taste in the mouth, nausea, heartburn, vomiting, constipation alternating with diarrhea, skin jaundiced to a more or less degree, and pain in the back between the shoulder-blades (liver pain); also there are usually considerable pain and tenderness in the hepatic region. In diseases of the liver the portal circulation is disturbed; the flow of blood being interfered with may cause dropsy, piles, or the formation of gallstones, or may cause hemorrhage of the engorged stomach or bowel.

The morbid conditions of the liver in which electricity will prove beneficial are congestion (enlargement) and cirrhosis. Faradization has long held first place. It increases the circulation of the liver, and consequently leads to an increase of the excreted urea. In applying the faradic current to the liver, one pole should be placed over the spine in the lower dorsal region and the other applied over the region of the liver, even carrying the electrode partially under the ribs. In many instances, however, where there is a torpid liver associated with a torpid condition of the bowels, the galvanic current seems to give greater results than the faradic. In such cases the positive pole is to be applied over the region of the liver, and the negative placed over the spine between the shoulders. Dr. L. J. Kohnstamm * recommends a galvanic current of high amperage (20 to 50 milliamperes), with rapid interruptions (600 to 700 per minute). He advises the patient to take an alkaline bath (alkalinized with carbonate of soda). He moistens the electrodes with solution of salicylate and biborate of soda in equal parts, and places the positive directly over the liver, and the negative to the lumbar plexus. His conclusions in regard to the electrical treatment of morbid conditions of the liver are as follows: (1) Of the various forms of electricity, the galvanic current is the only one which is of positive value in the treatment of the diseases of the liver. (2) Galvanism of low amperage is valueless, while galvanism of high amperage cannot be used, on account of its strong local caustic action. (3) The galvanic interrupted current of high

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* *The Journal of Electro-Therapeutics*, April, 1895.

amperage is the only one indicated. (4) In the absorption of exudates or in the stimulation of a gland, hyperæmic, in active or passive state, it is the galvano-chemical action of the current which brings about the resolution we strive for.

In the treatment of hemorrhoids by electrolysis * Dr. J. B. Bacon advises the use of a long pair of forceps, somewhat similar to urethral forceps, but insulated throughout except half an inch of the tips, with a set-screw on the handle of the instrument. The forceps are connected with the positive pole, and the tumor is seized in such a way as to allow the uninsulated tips to grasp its base; the negative pole is connected with a needle-holder containing four needles; then inject four drops of a four per cent. solution of cocaine into the tumor, and allow it time to act; the needles are then introduced into the center of the tumor, and a current of from 5 to 10 milliamperes should be allowed to pass until the hemorrhoid becomes of a whitish gray color (from two to five minutes), and the result will be the final absorption of the tumor.

The following suggestions, as given by Dr. Bacon, should be followed closely, or the operation may not only prove a failure, but also a source of danger: " Give an enema and thoroughly empty the colon before operating. Disinfect the tumor before introducing the needles, and again after the operation. Never use this method in acutely inflamed hemorrhoids. Do not use over one-sixteenth of a grain of cocaine hypodermically. Always insert the needles into the tumor before the current is turned on, and have the assistant turn the current off before withdrawing the needles. Use a milliamperemeter for measuring the strength of the current, as it is impossible to estimate the varying resistance of the tissues in different cases. The needles may be a direct source of infection in the hands of a careless operator, and they must be boiled before using."

Electrical Treatment of Constipation.—The frequent and injudicious use of powerful purgative medicines, and the constant dilatation of the bowel as the result of retained fæces, and the constant use of enemas, all have a tendency to cause paralysis of the peristaltic movements of the intestinal tract—the result being constipation. A torpid condition of the liver, loss of power in the abdominal muscles, and protracted diarrhea may also act as causes. Some of the most obstinate cases of constipation are due to the long-continued use of injections of glycerine. Glycerine has a tendency to leave the rectal membrane in a very dry condition; the same is true of the constant use of injections of water, but not to such a marked degree.

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* *The Journal of Electro-Therapeutics*, June, 1893.

In electricity we have a most efficient remedy for the treatment of this troublesome and obstinate affection. No other single therapeutic measure surpasses its scientific use in this affection. The objects of electricity are: (1) To increase the action of the liver by increasing the arterial, and thus decreasing the venous, blood supply; or, in other words, to relieve a torpid condition of the liver. By this means the nutrition of the liver is increased, and as a consequence there is a corresponding increase in its secretions, which aid in the digestive process. (2) To stimulate the muscular tissue and glands of the intestines. It is a physiological law that by increasing the nervous and muscular tissue of any organ you increase the nutrition of that organ, and when you increase the nutrition of any organ that possesses glandular tissue you increase the activity and secretion of these glands.

The above objects are obtained from the use of the galvanic current. We have had better results from the method of applying the galvanic current as given by Dr. W. H. King* than from any other form of current or method of application. His method of application and the reasons for it are as follows: "When we come to the first consideration, that of increasing the secretion of the liver, the best results will be attained by placing a large flat electrode over the posterior, and a flat hand electrode over the anterior region of the liver. The direction of the current is of great importance. The positive should be attached to the anterior and the negative to the posterior electrode. . . . When we come to the second part, the stimulation of the intestines, we should reverse the direction of the current. Of course this is perfectly logical, as we wish to concentrate the stimulating catalectrotonic effect of the negative pole on the intestines. The large flat electrode should be moved to the sacral region. The flat hand electrode should then be given labile over the abdomen for about three minutes, and then stabile over the sigmoid flexure. When we come to consider the physiology of the sigmoid flexure and rectum in the act of defecation, we would undoubtedly conclude that those parts would be the ones which should be most stimulated. Clinical observation bears out this theory, and it will be impossible to cure an obstinate case of constipation without concentrating the current for a few minutes over these parts. . . The treatment should be given for twenty-five or thirty minutes, and divided equally between the liver and intestines. The strength of current used will naturally vary with the sensitiveness of the patient, but one should always try to reach 20 ma., and it is unnecessary to go beyond 35 or 40 ma."

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* *The Journal of Electro-Therapeutics*, July, 1893.

In the treatment of constipation with the galvanic current rarely is it necessary to introduce an electrode into the rectum. It is only necessary, as a rule, in those obstinate cases of constipation where the rectal membrane is excessively dry, the result of long-continued use of rectal injections of water, or more especially glycerine. In such cases it should always be the negative pole that is attached to the rectal electrode.

The faradic current will, in many instances, prove of great service in the treatment of constipation. It is especially useful in those cases where there is a loss of power in the abdominal muscles; also in cases associated with atonic dyspépsia. It acts as a vigorous stimulant to the muscular fibers of the intestines. It may be applied by means of the unipolar or bipolar method. In the unipolar method one pole is introduced into the rectum, while the other is applied externally to every part of the abdomen. In the bipolar method both poles are introduced into the rectum by means of a bipolar electrode; care being taken that the metal portions of the electrode are are passed entirely within the sphincters. The strength of the current, when using either method, may be safely left to the sensations of the patient; whatever can be borne without great discomfort is safe to use. Flatulence, colic, etc., are relieved by faradization, the positive pole being inserted in the rectum and the negative moved over the abdomen.

Ascites.—Dropsy of the abdomen, due to various causes, has been successfully treated by faradization of the abdomen.

Cystitis.—The bladder, after being emptied, is partially filled with warm water and an electrode is introduced and connected with the negative pole of the galvanic current; a broad flat electrode applied over the bladder or sacrum is connected with the positive. The current should be very mild and the sitting from three to five minutes.

Impotence.—In the treatment of impotence both the galvanic and the faradic currents are used. When the galvanic current is applied, the negative pole is to be attached to an insulated urethral electrode, which is introduced into the urethra. The positive pole is attached to a large flat electrode, which should be placed over the lumbar region. A mild current should be used for from five to eight minutes, and the sitting repeated once or twice a week. In some cases good results are obtained by simply applying the negative pole to the testes and penis, the positive being applied to the back. When the faradic current is used, one pole may be applied to the back and the other to the glans penis, or place the testes between two wet sponge electrodes.

Incontinence of Urine.—The galvanic, faradic, and static currents have all been employed and proven of benefit in this troublesome and ofttimes obstinate affection.

When the galvanic current is used, one of two methods may be employed. The first method (percutaneous method) is to apply the negative pole directly over the region of the bladder, the positive being placed over the cervical or lumbar regions. The second method (direct method) is to place the negative pole in the urethra, the positive just above the symphysis pubis.

When the faradic current is used a slender bougie containing a metallic conductor, which terminates in an olive-shaped tip, is introduced into the urethral canal and placed in contact with the neck of the bladder (but never enter the bladder). The other electrode (a large flat one) is placed upon the lower abdominal region. A mild current is then passed for two or three minutes. King advises giving only from 60 to 100 faradic contacts or shocks.

In applying either the galvanic or faradic currents the best results are attained by applying the electricity directly to the urethral canal. It is not always necessary to introduce the electrode as far as the neck of the bladder; often if it is introduced only half an inch it will be sufficient. This method so far surpasses the first method (that is, of applying the electricity extensively over the region of the bladder) that it should be employed almost exclusively. Often three or four treatments by this method, especially with the use of the faradic current, will be sufficient to cure the most obstinate cases.

When employing static electricity the patient should be insulated and sparks applied directly to the spine or to the hypogastric regions just over the bladder.

Chronic Prostatitis.—In chronic inflammation of the prostate the application of the galvanic current to the prostatic portion of the urethra is often followed by excellent results. Dr. G. B. Massey of Philadelphia recommends that the negative pole be applied by means of Newman's olive-shaped sounds properly insulated, or, in old men, by converting a prostatic curved silver catheter into an electrode by covering it with fused shellac or hard rubber, except a small space back of the eye. The catheter electrode will accurately indicate the neck of the bladder by means of the flow of urine. The treatments not oftener than once a week. He says that for most cases of deranged function and incipient enlargements of the prostate rectal applications of the galvanic current are usually sufficient. An olive-shaped ball is the active electrode, and should be about the size of the end of the index finger and mounted on an insulated staff. This is pressed against the under surface of the gland. The indifferent pole should be placed upon the abdomen.

Stricture of the Urethra.—The removal of strictures by means of electrolysis has many points of advantage in its favor; the results being more satisfactory and more permanent than when the dilatation alone is employed. The advantages of electrolysis over surgical procedures are that, once cured, no relapse takes place; no after-treatment with bougies is required; there is no pain, no hemorrhage, no febrile reaction, nor any ill effects following the operation; nor is the patient confined to his bed.

Dr. Newman * offers the following suggestions in regard to this method of operating:

1. Before operating, the susceptibility of the patient to the electric current should be ascertained.

2. The problem is to produce absorption, and not cautery; therefore weak currents at long intervals are best.

3. The best position for the patient to assume during the operation is that which is the most comfortable to him and the operator. It may be either the erect or the recumbent.

4. Anæsthetics are to be avoided, as it is best to have the patient conscious and able to tell how he feels. If, however. the urethral canal is exceptionally sensitive, an injection of a four per cent. solution of cocaine may be used.

5. Care must be taken to keep the electrode in line, so that the point may not deviate and make a false passage.

6. Force must not be used. The bougie must be guided in the most gentle way, and electricity alone be allowed to do the work.

7. During one séance two electrodes in succession should never be used.

* "The International System of Electro-Therapeutics."

8. It must not be forgotten to stop the current before withdrawing the electrode, otherwise acute pain will be induced in the course of the urethra, which often remains some time.

9. Pain should never be inflicted during electrolysis; therefore it should not be applied when the urethra is in the acute or even subacute inflammatory condition.

10. It is well to leave a little urine in the bladder. It serves to diffuse the stimulus and is more agreeable to the patient than when the bladder is empty.

In addition we would offer the following suggestions:

1. Always test the polarity before beginning an operation. The simplest method is to immerse the metallic tip of the conducting cords in water and turn on the current. The tip around which bubbles gather the most quickly is the negative.

2. It is important that the *negative* pole be connected with the urethral electrode, otherwise it will become glued to the tissues so that it cannot be removed without violence, and the cicatrix which forms where the positive has been applied, is liable to contract and form a worse stricture than the one it was intended to remove.

3. It is better to measure the distance of the stricture from the meatus before beginning the operation.

4. Select an electrode about three sizes larger than the exploratory sound which passes the stricture; also in a second operation use a sound three sizes larger than the one used at the first sitting.

5. Pass the electrode down to the stricture, and when it passes through carefully guide it with the thumb and finger along the canal until it comes to another; or, if there be no more, until it enters the bladder.

6. After the bulb passes through a stricture or strictures, it should be withdrawn slowly, and each stricture well worked out—that is, until the bulb will pass and repass the stricture without catching on the edges.

7. If the urethral canal is highly inflamed an operation is contra-indicated until the inflammatory condition subsides.

8. It is better to lubricate the sound with glycerine, as vaseline or grease of any kind has a tendency to act as an insulator.

9. The strength of the current should not exceed 5 milliamperes; in the greater majority of cases 2 or 3 will be sufficient.

10. It is essential to have a milliamperemeter to measure the current correctly.

11. A second sitting should not be sooner than seven to ten days.

12. No other instrument to be introduced into the urethral canal between the treatments.

13. The positive pole to be applied to some indifferent part of the body, as the sacrum or the inner part of the thigh.

Stricture of the rectum is treated on the same principle as stricture of the urethra, with the exception that stronger currents (5, 10, 15, and even 20 milliamperes) will be required and the séance closer (four to seven days).

Rheumatism.—Acute articular rheumatism is very little benefited by electricity in any form. In the subacute variety, or after the acute symptoms have subsided, much benefit can be derived from the use of electricity.

The most satisfactory results obtained from the use of electricity in the various forms of rheumatism is in that known as *muscular* rheumatism. Electricity acts beneficially in relieving the pain and stiffness of the muscles. All three forms of electricity—galvanic, faradic, and static—are of value in the treatment of this affection, but in the majority of cases static electricity will prove to be the most efficient of all the electrical methods. Especially is this true of the static induced current. In acute muscular rheumatism this current is superior to any other kind of electricity; its action being almost that of a specific.

In the selection of a current for any given case Beard offers the following suggestions: (1) If the pain is of the neuralgic type and there is considerable tenderness to pressure, especially light pressure, either the galvanic or faradic current of high tension (preferably the galvanic) should be chosen. (2) If, however, the pain is dull and aching, seemingly very deep-seated, and not aggravated by pressure, static electricity is capable of far greater relief than either of the other forms.

Lumbago.—Many cases of lumbago, after suffering for days or even weeks, can be relieved in many instances by a single application of static electricity. As a general rule the treatment should consist of negative insulation, with application of the sparks by means of the brass ball electrode; or another method, which is more efficacious, is to pass the roller electrode over the affected parts. When the faradic current is applied, the secondary current is the one to be selected; one pole to be applied labile directly to the muscles affected and the other placed over the abdominal region.

Carbuncles and Furuncles.—These may be dissipated in their earlier stages by applying the negative electrode upon them and the positive at some indifferent point. The static sparks, however, surpass any other form of treatment, electrical or otherwise, in the treatment of these painful affections. If taken in their earlier stages, and even after being well developed, a single application of the static sparks will often cause them to wither up and disappear within forty-eight hours. The patient should be insulated and sparks applied directly to the carbuncle or furuncle.

Lateral Curvature of the Spine.—Spinal curvature is due, in the greater majority of cases, to a weakening of the muscles of the spine and back which act as a support in keeping the spinal column and back in an erect position. Many cases of lateral curvature of the spine can be successfully treated without mechanical appliances (braces, jackets, etc.) by the use of electricity. In lateral curvature, then, the object would be to strengthen the muscles by stimulating them with electricity. For instance, if the spinal column curved to the left, it would be the muscles on the right side only of the column that should be treated. Those on the left side should be left severely alone, for their power already is too great, and any stimulation of them would render the deformity greater. The principal muscles to be acted upon would be the *trapezius* and the *latissimus dorsi.* The motor points of these muscles, as determined by Dr. W. F. Robinson, are as follows: The trapezius has two motor points, each located about one inch from the median line. The upper one is located at the point where the back runs into the neck. The lower one will be found just opposite the spine of the scapula when the arm is allowed to hang down by the side. There is possibly a third point a trifle further from the median line than the two just mentioned and about opposite the lower angle of the scapula. The motor point of the latissimus dorsi will be found about two inches below the lower angle of the scapula and three inches from the median line.

These are the points, then, to which the faradic or static induced currents are to be applied to obtain contractions of the muscles which they represent.

In a case of spinal curvature in which the curve was continuous from the cervical to the lumbar region (simple lateral curvature), and if the spine curved toward the left side, the trapezius and latissimus dorsi muscles of the right side would be treated; but in a double curvature of the spine, say the spine curved to the left in the lumbar region and to the right in the dorsal region, the latissimus dorsi of the right side and the trapezius of the left side should be stimulated.

The galvanic, faradic, or static induced current may be employed. In applying the galvanic current it should be applied not only to the motor points, but also to the whole extent of the muscle so as to increase the nutrition. The static induced current is, as a rule, to be preferred to the faradic, as it is a more powerful tonic to the weakened muscles and has the advantage that there is no pain accompanying its application.

Asthma.—Haynes says that asthma, due to a morbid state of the nerves or its coverings, is relieved by placing the positive pole over the pneumogastric in the left side of the neck and the negative over the nape of the neck. A very mild current should be employed lest the heart's action be arrested or the difficulty in breathing increased. Asthma due to reflex action of the nerves, caused by disease of other parts than those named, cannot be permanently relieved by electricity until the disease giving rise to it is removed. Arthius states that when asthma exists without organic lesions, the franklinic electric bath, the patient being seated upon an insulated platform, will cure it. When due to catarrh, electricity alone will not cure, but is the surest means to obtain an amelioration and make life endurable.

The Electrical Treatment of Diseases of Women.

The scope of these lectures will not permit us to go into details as to classification, causes, pathology, etc., of the various morbid conditions of which we shall speak (all these can be obtained from any text-book on "Diseases of Women"), but simply to name the affection to be treated, to give quite briefly an account of the facts which have been established, and to give the form of current and the methods of its application to that particular disease or condition.

Amenorrhœa.—(*Absence of the Menstrual Flow*).—Of the many ailments that women have to bear none causes so much complaint as the derangement of the menstrual functions. Every twenty-eight days (beginning at about the twelfth or fourteenth year and continuing about thirty years) a woman should have what are termed the "monthlies," "periods," "menses," or "flows." This varies in amount in different women even in health, and lasts, usually, from three to five days. When there is an absence of this flow, the condition is known as *amenorrhœa*.

There are two distinct varieties of amenorrhœa: (1) Where menstruation is absent and has never appeared. (2) Suppressed menstruation, where the flow, after having been established, ceases to appear at its regular intervals.

Scanty or irregular menstruation is usually classed as a variety of amenorrhœa; but, strictly speaking, it is not a true amenorrhœa.

Non-appearance of the menses may be due to a non-development of the uterus and ovaries, or, in rare instances, an absence of these organs; general anæmia; chlorosis; exhaustive constitutional diseases, such as tuberculosis, Bright's disease, etc., fright, grief, mental overwork, indolence, luxury, want of fresh air and exercise. Girls who have been raped or who have "gone astray" may become so anxious and worried about their condition as to cause them to pass over their regular time several days or even weeks; the same holds good in recently married women.

It is in the treatment of amenorrhœa that electricity has achieved such brilliant results. Of all the misfortunes that women have to bear, in none will electricity prove more useful and effective.

Too often electricity is employed to "force" the monthlies in certain cases where such a result cannot but prove harmful; for instance, amenorrhœa occurring in a girl or woman who is suffering from chlorosis, general anæmia, or tuberculosis, should be left severely alone, for it is nature's way of conserving her strength.

There are two methods of applying electricity in amenorrhœa: (*a*) the external method; (*b*) the internal method.

In the external application of electricity galvanism is the preferable one to use. The spine should be thoroughly galvanized. The direction of the current is of great importance; a descending current, by its reflex and radiating action, affects more profoundly the different organs of the body which receive their nervous impulse through the spinal nerves than an ascending current; it acts by producing a turgescence of the pelvic vessels, and is especially stimulating to the uterus and appendages. The positive pole should be placed over the nape of the neck, the negative over the lower sacral region, and the current permitted to flow for six or eight minutes. A good effect is obtained by passing the negative electrode over the region of the ovaries and the lower part of the abdomen, just over the pubes, thereby including the pelvic organs directly in the circuit. The treatment should be twice a week, and continued until two or three normal or nearly normal periods have been passed, and then once a week for several applications.

In many instances the static sparks passed along the spine and over the ovarian and uterine regions will prove of great benefit.

In obstinate cases of amenorrhœa the internal method of applying electricity will have to be resorted to. In fact, it is better to treat almost all cases of amenorrhœa by this method, as the results are obtained much more quickly than by the external method. In the case of young girls, however, a physician is not justified in applying electricity internally until a faithful trial of the external method has been employed. In the internal method both the galvanic and the faradic currents are to be employed. They may both be employed at the same sitting or in alternate sittings.

When the galvanic current is to be used the positive pole is to be placed over the sacral or cervical region (preferably the latter), and the negative is to be connected with the internal or uterine electrode, which is insulated so as to protect the vaginal parts, and then, after careful antisepsis of the vagina and cervical canal, introduce this electrode into the fundus of the uterus. The strength of the current should not exceed 5 milliamperes, the sittings not over five minutes. This method of treatment stimulates the uterus and its appendages, causes a flow of blood to those organs, and at the same time leaves the canal of the uterus in a patulous condition, thereby affording a better facility for a free passage of the menstrual flow when it should start.

When using the faradic current the best results are attained by applying the current inside of the uterus by means of a bipolar electrode. The strength of the current should be just what the patient can bear. Intra-uterine bipolar faradization may be employed to stimulate the uterus (in that case the primary current) or to allay the pain induced by the use of the galvanic current (in the latter case use the secondary current).

Bipolar intra-uterine faradization is especially useful in those cases of scanty menstruation and amenorrhœa occuring in women soon after marriage, who, as the menstrual flow diminishes or stops, become stouter and stouter.

Dysmenorrhea.—(*Painful Menstruation*).—Many women never pass the menstrual period without pains, more or less distressing. When these pains are slight and of short duration the period may be passed without any inconvenience; but in those cases of painful menstruation to which the term dysmenorrhea has been applied, the patient may suffer from distressing and agonizing pains for hours before relief is obtained. In many instances the pains are quite as severe as in labor or abortion.

The pains are usually located in the region of the womb, and radiate from that point to the small of the back and down the thighs. The pains may make their appearance a few hours before the flow starts, or may not come on until after a slight " show " has appeared, and usually as soon as the flow comes freely the pains disappear.

According to the usual classifications, there are five varieties of dysmenorrhea: (1) Neuralgic; (2) congestive; (3) obstructive; (4) membraneous; (5) ovarian.

In the treatment of these various forms of dysmenorrhea one point should be kept in mind—namely, that in each and every variety there exists a catarrhal inflammation of the lining of the womb (endometritis), and to effect a permanent cure of the dysmenorrhea a healthy condition of the endrometrium will have to be established.

In the treatment of dysmenorrhea the first object to be attained is free drainage from the uterine canal. This is accomplished by dilatation of the cervical canal.

The negative pole of the galvanic current, properly employed, is one of the best means of dilating the cervical canal. One of the best electrodes for this purpose is Goelet's dilating negative electrode for the cervix. This electrode consists of five graduated bougie tips, the smallest being the size of the uterine sound. Before beginning a treatment, care should be taken to render the vagina and mouth of the womb as antiseptic as possible. Then introduce the negative electrode (begin with the smallest one) along the finger as a guide, or a speculum may be employed if so desired,—as a rule, it is better to employ one,—but care must be taken that the electrode does not come in contact with it while the current is turned on, or it will cause a severe and painful shock to the patient. The sound can be applied with greater nicety and less pain through the speculum than with the finger; also, there is less danger of conveying germs to the endometrium through the sterilized speculum than with the finger alone in the vagina. Dr. W. L. Jackson has suggested that it would be better to use the round celluloid speculum, as it can be perfectly sterilized, and will not inconvenience the patient by its weight during the treatment; also, another point in its favor is that, as it is a non-conductor, there will be no straying of the current if the electrodes rest upon it. The positive electrode may be placed either over the lumbar or abdominal regions.

When the current (in strength 8 to 12 milliamperes) is turned on, the negative electrode should be pressed gently (do not use force) in the direction of the curve of the canal; and after it passes the internal os, it should be passed to the fundus of the womb, and allowed to remain in that position for one or two minutes. While the current is still passing, the electrode should be gradually drawn through the stenosed portion of the canal, and then the current shut off.

In many instances an application of this kind is followed by a severe and distressing pain. To prevent this, or to relieve it if present, employ bipolar faradization of the vagina with the current from the fine wire coil for five or ten minutes.

Goelet * advises, after complete dilatation has been accomplished, to occasionally apply the positive pole to the whole endometrium, including the cervix. This exerts a tonic effect

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* "The Electro-Therapeutics of Gynecology."

upon the uterus, diminishes the secretions, and hastens resolution. The current, as a rule, should not exceed 15 or 20 milliamperes; though ocasionally it will be necessary to apply 30 or 40 milliamperes.

After a course of treatment varying from one to three months by the above methods, neuralgic pains, uterine fixation, inflammation, and hyperæsthesia and hypertrophy of the mucous membrane will, as a rule, disappear, and the patient be entirely relieved from her dysmenorrhea.

In dysmenorrhea of purely neuralgic type, bipolar vaginal and intra-uterine faradization—current of tension—gives the best results.

Sterility.—Sterility due to stenosis of the uterine canal will, as a rule, be overcome by dilating the canal and giving free drainage to the uterine cavity.

Dilatation may be performed (*a*) by means of a steel dilator without the employment of electricity; (*b*) by means of the negative uterine electrode.

There are several reasons why dilatation by means of electricity is preferable to rapid dilatation by means of sounds: (1) On account of its simplicity and safety; (2) it does not require the employment of an anæsthetic; (3) it is devoid of danger, unless imprudently used; (4) it leaves the cervical canal patulous, consequently allowing a better condition for drainage; (5) finally, in all cases of stenosis of the cervical canal there is more or less of a catarrhal condition of the lining of the womb, and by the employment of the negative electrode to overcome the stenosis this catarrhal condition is benefited.

In employing this method place the positive electrode over the lumbar or abdominal region, then select the smallest uterine electrode, and, after turning on the current (a very mild one), the electrode is made to traverse the cervical canal slowly; it will be arrested at the contracted portion until the electrolytic action permits it to pass without the use of force. When it passes the point of stenosis, introduce it into the fundus of the uterus, and let it remain there three or four minutes; then slowly withdraw it, but before it leaves the canal turn off the current.

The use of the negative pole not only secures the drainage of the uterine cavity and fallopian tubes, but also destroys the diseased mucous membrane lining the uterus; or, in other words, cures the endometritis which so frequently coexists with sterility.

The treatment should be given often enough to keep the cervical canal open and in a patulous condition; usually one treatment a week, until six or eight have been taken, then once or twice a month for a few months, unless the patient should have become pregnant.

Sterility is more often due to endometritis and the consequent alterations in the secretions from the uterine and cervical mucous membrane, so that it has become acid or otherwise fatal to the spermatozoa, rather than to stenosis of the cervical canal. For the treatment of such conditions, see "Treatment for Endometritis."

Sterility due to want of development of the uterus can be cured in many cases by bipolar vaginal and intra-uterine faradization with primary current.

By the use of the galvanic current (negative pole intra-uterine) sterile women in whom the menstrual flow has been growing less in quantity and irregular in their appearance, who at the same time have been growing stouter and stouter, have been made to menstruate, and, all other conditions being favorable, to conceive and bear children.

Menorrhagia (*Uterine Hemorrhage*).—In the treatment of hemorrhage from the womb employ the galvanic current (an exception to this is in *post-partum* hemorrhage, when the faradic current will prove the most serviceable), the positive pole in the uterus and the negative electrode (a large clay electrode) on the abdomen. If the bleeding is not very profuse, and the uterine canal is narrow, an ordinary platinum sound will be sufficient to make the application with; but if the bleeding is excessive, and the uterine cavity is large, this sound will not answer the purpose; for to get the hemostatic action of the positive pole the sound has to come in direct contact with the lining of the womb. In such a case a carbon electrode will have to be employed and the cavity of the uterus cauterized in sections.* The carbon electrode will be called for especially in those severe hemorrhages which so often occur in connection with fibroid tumors, where, if not checked promptly, they may jeopardize the life of the patient.

Post-partum hemorrhage and all hemorrhages from the uterus due to relaxation of muscular fibers are best treated by the faradic current, one pole to the uterus and the other to the abdomen. The control of uterine hemorrhage by electricity is one of the things in medicine that can be almost, if not quite, assured. In fact, no measure or remedy will prove as efficient in controlling *post-partum* hemorrhages as bipolar faradization. It causes an immediate strong uterine contraction, and is a sure and safe remedy, even in hemorrhage of the most severe type. Jacobi says that if the positive pole is applied to the uterus, it not only often arrests hemorrhage at the time, but so narrows the vascular channels that all the following menstruations, previously hemorrhagic, become markedly diminished in quantity.

Endometritis and Metritis (*Inflammation of the Lining of the Womb and Inflammation of the Structure of the Womb*).†—The treatment of endometritis and metritis is practically the same, for in metritis there is always endometritis, and the treatment for endometritis cures metritis where they coexist.

In the acute stage the galvanic current is prohibited. The faradic current (the secondary only) may be employed in the form of bipolar vaginal faradization to relieve the pain. In the subacute form of endometritis the judicious use of the galvanic current will check the disease before it assumes the chronic form.

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* The best kind of electrode to be used is the carbon-bulb set of Apostoli, made in this country by Fleming.

† Massey says that all forms of uterine inflammation (endometritis, endocervicitis, metritis, etc., etc.), are due to the same cause—microbic in origin—and hence are pathologically identical, except as varied by the particular microbe concerned and the local structures.

Of the treatment of this affection Goelet * says as follows: "It must consist in maintaining a patulous canal for drainage of the secretions from the cavity of the uterus and mild astringent or styptic applications to the impaired endometrium. The first indication can be obtained by the occasional passage of the bare metallic cervical electrode connected with the negative pole of the galvanic battery with from 10 to 20 milliamperes. The procedure must be repeated as often as required in the course of the treatment for fulfilling this indication. The second indication is met by a mild positive galvanic application of from 20 to 30 milliamperes, for five minutes every second or third day, and a platinum sound electrode, which is bare from the external os to the fundus, should be employed. As improvement becomes apparent, the intervals between the applications may be lengthened, and the strength of the current may be lessened to 10 or 15 milliamperes."

In the treatment of chronic endometritis and chronic endocervicitis, a cure must aim at the complete destruction of the diseased mucous surface.† This is accomplished by applying the positive pole (platinum or carbon electrode) directly to the mucous surface. The indifferent pole, a large dispersing electrode, is placed on the abdomen.

Quite frequently, however, where the cervix is large and indurated, the negative pole will have to be employed to soften the tissues of the cervix before the positive electrode can be used; also where the canal is filled with thick, tenacious mucus the negative pole will have to be employed before the positive,

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*"The Electro-Therapeutics of Gynecology," Part II.

† Massey says that should the endometritis be complicated by a salpingitis or other peri-uterine inflammation, as indicated by a fixation of the uterus, all intra-uterine explorations or treatment should be postponed as unsafe, and recourse be had to vaginal application of from 50 to 100 milliamperes negative, which most quickly restore the uterus to a movable condition.

to dissolve and remove the secretions. It would be useless to attempt to cauterize with the positive pole without first removing the secretions from the canal, for the action of the positive pole would cause them to become coagulated, and thereby afford protection for the diseased surface underneath.

The strength of the current to be employed will vary. In the beginning of the treatment it is usually better to begin with about 50 milliamperes, and later to increase the strength to 100, 150, or 200 milliamperes if necessary, always keeping in mind the susceptibility of different patients to the effects of electricity.* In the greater majority of cases, however, it will not be necessary to exceed 60 to 75 milliamperes. The duration of the treatment should be about twelve or fifteen minutes, after which the current is gradually reduced to zero, reversed, and 15 to 20 milliamperes are allowed to pass for five or six minutes, so as to get the relaxing effect of the negative current; otherwise it would often be a difficult thing to remove the electrode, on account of its being glued firmly to the endometrium (a natural sequence of positive cauterization). "There will be in most cases a bloody discharge from the uterus, which will last several days, and may even run into the regular period. The patient should be forewarned of this, lest she be discouraged and unnecessarily alarmed by it." (W. L. Jackson.)

Care must be taken that these applications are not made too frequently. An application is not to be made until the effect of the previous cauterization has disappeared—that is, until the surface has entirely cleared off. Not more than two treatments should be undertaken during each intermenstrual period.

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* On account of the small amount of resistance to the current passing through a moist mucous surface, a current of enormous strength, as compared with that which would be necessary to cauterize the skin, is required to produce any cauterization effect on a mucous surface. A continuous current of 200 milliamperes may be applied without pain in a gynecological treatment when *slowly* increased to that intensity; *rapid* increase is very painful, and *sudden* making or breaking would be almost unbearable.

As a general rule the platinum sound is used; but where the uterine cavity is enlarged, or where there is profuse leucorrhœa, the carbon electrode is preferable, for it comes more directly in contact with the whole mucous surface than the platinum sound.

There is probably no method or means that has ever been employed that has proven more effective than the intra-uterine application of the galvanic current in this troublesome and obstinate affection—inflammation of the lining of the cervical canal and womb.

The beneficial results obtained from electricity employed in this manner will be a grateful surprise to anyone who will try it, for it is far superior to the older methods of iodine, carbolic acid, etc.

Hemorrhagic Endometritis.—The positive pole of the galvanic is always indicated, though at times it is advisable to use the negative first for the purpose of dissolving thickened secretions. Massey gives the following directions: "Select the largest one capable of being inserted, pass it gently to the fundus, and then turn on a current of 40 to 100 milliamperès. The electrode is held in this position from one to three minutes; the current is then lessened, and with the fingers in the vagina, locating a notch, the electrode is withdrawn until another notch is touched; then the current is again turned on to the same strength and for the same duration. This sectional cauterization is repeated until the bulb again impinges on the internal os, the whole of the endometrium being thus brought into contact with a concentrated polar action." It is not always necessary, however, to give such thorough treatment. This form of treatment will only be necessary in the more severe cases. In the milder cases the covered elastic platinum electrode will answer all purposes.

Chronic Peri- and Parametritis (*Post-Inflammatory Pelvic Deposits*).—Vaginal galvanic applications of from 20 to 50 milliamperes for five minutes, positive pole in the vagina, with a large electrode on the abdomen. If the deposit is localized, the vaginal electrode should be placed directly against it; but if it is not localized it is better to place the electrode directly against the cervix, so that the current may traverse the whole structure of the uterus. At each sitting the galvanic applications should be followed immediately by bipolar faradization of the vagina for five or ten minutes. When the exudation is chronic and the positive pole fails to cause its disappearance, good results will be obtained by substituting the negative current for the positive in the vagina, using from 50 to 100 milliamperes. This hastens absorption and softens and relaxes the adhesions.

Subinvolution.—This is a condition in which the uterus is found occupying a lower position in the pelvis than normal, sometimes coming quite down to the mouth of the vulva, and at the same time it is congested, enlarged, and relaxed. It follows quite frequently after labor and after abortions and miscarriages.

In electricity we have an energy which is capable of causing the uterus to contract and assume its normal weight and position. The primary faradic current is the form of electricity that will prove the most serviceable in this affection; in fact, there is not another remedy its equal. In the beginning it should be employed by a bipolar electrode to the vagina, and later by means of the intra-uterine bipolar electrode to the cavity of the uterus. The treatments may be repeated every other day or every third day, according to the severity of the case. Sanguineous discharges continuing beyond the normal periods of their appearance, or recurring during the first weeks after parturition, may be controlled by one to three of these applications. Either the bipolar or unipolar method may be used.

Where the subinvolution is due to septic endometritis, the results of shreds of retained decidua or a laceration, the galvanic current is indicated, the positive pole in the uterus and the negative on the abdomen.

Where the uterus is bound down by adhesions due to pelvic peritonitis, electricity will often prove of great service in causing an absorption of the inflammatory products, thereby relieving the uterus and allowing it to assume its normal position.

Ovaritis (*Inflammation of the Ovaries*).—In the acute stage the treatment should be either intra-uterine or vaginal bipolar faradization with the current of tension (secondary current). The current from the long, fine wire is sedative in its action, and should be applied a sufficient length of time to relieve the pain. A treatment should be given every day or every other day, or just often enough to keep the pain allayed.

It is advisable in many instances to use the galvanic current in the acute stage. It also, as well as the secondary faradic current, will give relief to the pain, and at the same time will set the absorbents to work in the cure of the disease. In the earlier stages (acute and subacute) of the disease the positive pole, on account of its sedative qualities, should be employed as the active internal electrode; later, when the pain and sensitiveness to pressure are diminished, the negative pole should be employed as the active or internal electrode, on account of its absorbent power. For the internal electrode, use the carbon ball clay-covered electrode. This should be introduced into the vagina up to the vault, as near to the affected ovary as possible. The indifferent electrode is placed over the abdomen or over the sacrum, preferably the latter position if the ovary is displaced downward and backward, for in that case the current passes directly through the affected organ. The strength of the current will vary according to the stage of the disease. In the earlier stages 30 to 50 milliamperes will usually be sufficient. In the later stages 75 to 100 milliamperes may be administered, but generally it is not necessary to exceed 75 milliamperes. The sittings should be about five minutes. The galvanic application should be followed by vaginal bipolar faradization for ten of fifteen minutes. The treatment should be given twice or three times a week for the first month, and then lengthen the intervals as improvement follows.

The length of time required to effect a cure in these cases will depend upon whether the cases are recent or of long standing. On this point Dr. Edward Sanders of New York says: " If the cases are recent, one to two months is sufficient to bring about a cure; if of long standing six months or even a year are consumed in bringing this about. But this is nothing when we recall that months and years pass under simple medical treatment without any result whatever; while surgery, which jeopardizes life, actually requires from one to two years after operation to effect a cure in not a few cases. In electricity we have a remedy which is absolutely without a particle of risk, which does in six months or a year what medicine fails to do and what surgery can only do in twice the time with greatly added suffering and dangers. The method is not painful; can be readily applied in our offices; allows the patient to go about her business afterward, subject, of course, to the usual limitations of caution; does not confine her one instant to her bed; requires no special preparation; and offers the best hopes of recovery."

The great obstacle in the treatment of these cases by means of electricity is that as soon as the pain is relieved the patient believes herself cured and consequently neglects her treatments, where, in fact, it is only the sympathetic sign that has been removed, the pathological condition still existing.

In cystic degeneration of the ovaries Goelet advises placing the positive pole in the vagina as near the cyst as possible, the external electrode placed over the lumbar or sacral region, commencing with about 30 or 40 milliamperes every second or third day, gradually increasing to 50 or 60 milliamperes, and lengthening the interval as the strength of the current is increased. From 80 to 100 milliamperes can, after a while, be employed once a week. He says that milder applications will not be effective.

Bipolar faradization may be employed during the interval between the galvanic applications. In some instances unipolar applications of the faradic current (one pole in the vagina and the other over the lumbar region) will give better results than the bipolar method.

The application of the static sparks to the hypogastrium of the affected side will sometimes afford great relief from the pain.

Ovarian and pelvic pains of a functional nature are quickly relieved by the judicious use of the faradic current. Many a patient has been subjected to an operation on account of these pains who could have been relieved by the fine coil or tension current (secondary current) with its sedative influence.

Pain and tenderness of uterine origin are often mistaken for ovarian disease. Many a woman complaining of pains down the limbs, in the abdomen, and in the back, and who was suffering from general nervous prostration, has had her case diagnosed "ovarian disease," and those inoffensive organs forthwith removed; and yet this measure bringing no relief whatever, on account of the true source of the trouble—a catarrhal endometritis—being entirely overlooked.

Vicarious Menstruation.—In the treatment of this affection Dr. Lapthorn Smith * offers the following suggestions: "If there is no dysmenorrhea the current from the fine wire faradic current (bipolar intra-uterine faradization) will generally be sufficient to attract a flow of blood to the uterus again and at the same time develop the uterus, which is generally found to be abnormally small. If, however, there is much pain at the menstrual period, the galvanic current (negative pole intra-uterine) will be preferable; because it is a specially suitable remedy for the endometritis which will in such cases generally be present.

Vaginismus.—Negative pole applied to the vulva by means of a vaginal electrode and held steadily in place and with gentle pressure (do not exert any force on the electrode) until it gradually slips into the vagina, and continue the sitting fifteen or twenty minutes. Galvanism will relieve the greater majority of cases; any exciting cause, of course, must first be removed.

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* "International System of Electro-Therapeutics."

Ptyalism.—Ptyalism of pregnancy is quickly cured, according to Dr. Webster, with galvanism, the negative pole applied to the tongue, and the positive pole held in the hand of the patient, or applied labile over the salivary glands on each side. The treatment should be given twice a week, and about 10 milliamperes used for three minutes.

For those severe forms of neuralgia and neuralgic headaches, which many women suffer from at about the cessation of the menopause (forty-eight to fifty years of age), nothing will relieve them so surely as will the faradic current, applied by means of an intra-vaginal bipolar electrode. Electricity applied in this way seems to have the power to draw the nervous irritation away from the brain and to start up functional activity in the sexual organs again. In many instances, after a few applications, there appears a watery sanguineous discharge from the uterus and then the neuralgic attacks diminish in severity, the intervals between their occurrence lengthen and eventually they disappear altogether.

For those cases which complain of an aching distress and bearing down sensation in the pelvis, not attended by inflammation but simply an hyperæmic condition, due to lack of tonicity in the uterus and its supports, electricity will prove a great boon. It will relieve the hyperæmic condition, tone up the parts and dispel the pains. Its method of application is as follows: The positive pole of the galvanic current applied high up in the vault of the vagina by means of the carbon ball clay-covered vaginal electrode; the negative pole applied either to the lumbar or cervical region; the sitting from eight to ten minutes; the strength of the current just sufficient to be comfortably borne. Often when a patient comes to the office complaining of the above symptoms, a single application will cause her to experience a sense of well-being and temporary relief from all distress, and if the treatments are continued, will eventually result in a complete cure of the case.

Electric Baths.

GALVANIC OR FARADIC.

Electric bathtubs may be constructed of metal, wood, or porcelain. The porcelain is far superior to either of the other varieties, although by coating the wood with white non-metallic enamel it serves almost as well. If the tub is of metal, a lathwork of wood must be placed in the bottom and on the sides, so as to prevent the patient from coming in contact with the metal.

The method of applying the current will vary with the construction of the tub. If the tub is of metal it will form one of the electrodes, one pole of the battery being attached to it. The tub would act as the passive electrode, the other electrode (the active) being connected with a large sponge and applied to any part of the body not under the water. If the tub is made of non-conducting material (wood or porcelain), one electrode is placed at the nape of the neck, between the shoulders, or on the back, and the other, in the form of a foot-plate, at the end of the tub against which the feet rest; by this arrangement the current is passed lengthwise through the body. The water should be deep enough in the tub to cover the patient's body entirely—the head being elevated. The water should be of a temperature ranging from 98° F. to 100° F. If, while taking the bath, the patient complains of a throbbing sensation or fullness of the head, place cold cloths on the head. If the patient complains of faintness, the current will have to be lessened or turned off entirely and the treatment suspended for that time.

An electric bath must not be taken too soon after a full meal. After taking a bath the patient should rest fifteen or twenty minutes before going out into the open air. The time required for giving the bath will vary from fifteen to thirty minutes. The total strength of current employed when galvanism is used will be about 200 ma. Only about one-eighth of this passes through the patient, the rest passing through the water.

An electric bath is especially useful in the treatment of morbid conditions which affect the whole constitution. It is especially useful in the treatment of chronic rheumatoid arthritis. The natural tendency of this disease is almost always from bad to worse, but even in the worst cases persisted treatment with the electric bath, combined with passive movements, will result in some improvement. Lateral sclerosis is another affection in which the electric bath is especially useful. The directions for its use in this affection are given in connection with "The Treatment of Lateral Sclerosis," which see.

The electric bath is sometimes useful in the treatment of mercurial and lead tremors. It will prove of great benefit in certain forms of cardiac affections. It stimulates the nerves and facilitates the action of the heart in such a way as to enable the latter to gain in nutrition. The effects are not temporary, but permanent; the symptoms losing their acute character, and the patient experiencing a great sense of well-being. The baths are, of course, only applicable in cases where the heart is not degenerated, and in which there is only cardiac cachexia.

Electric baths are invaluable in restoring the constitutional vigor after it has been impaired by excesses of any kind.

The bath is advantageously employed where the general applications of either the galvanic or faradic currents are to be made. By some it is claimed that it is the most thorough way of applying general galvanization or general faradization. Electrization is certainly more general by this method than by any other, but whether it is more effective or even as effective as when the electrodes are applied directly to the body is a question of doubt.

The Faradic Douche.—Engelmann,* in speaking of this, says as follows: "The douche proper, hot or cold, is used as the rheophore or conductor to carry the faradic current by which its efficiency is greatly augmented; a large plate electrode is applied as the indifferent pole to a near surface of the body, and a douche or spray, of proper temperature, is thrown from the fluid-carrying rheophore at a distance of six to twelve inches upon the part to be reached."

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* "International System of Electro-Therapeutics."

It is especially useful as a general application in neurasthenic cases and spinal weakness.

Hot Air or Vapor Electric Baths.—The following is an extract of Stevenson and Jones' * description of the method of applying this bath. This bath is given in a cabinet especially constructed for this purpose. The patient sits within this cabinet, nothing but his head without. Around his neck are placed warm towels to prevent the escape of the steam or hot air. This steam or hot air is generated within the cabinet by means of an alcohol lamp placed beneath the stool upon which the patient is seated, or carried into the cabinet by means of an apparatus connected with a boiler or heating apparatus outside. The vapor may be used at a temperature varying from 90° F. to 110° F. The hot air can be borne up to 130° F. A hot air or vapor electric bath occupies fifteen or twenty minutes; at the conclusion the patient should be cooled down by a shower bath. These baths are especially useful in chronic rheumatism, stiffness of the joints, and skin diseases.

The term " hot air or vapor electric bath " is misleading, for, although the patient is enveloped with hot air or vapor, the current can only be conveyed to him by means of contact with the electrodes. One pole being connected with the stool upon which the patient is seated, the other pole with special electrodes is applied to different parts of the body. A hot air or vapor electric bath is, therefore, nothing more than the application of electricity to a patient whose skin is rendered a better conductor through the warmth and perspiration that is induced.

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* " Medical Electricity," Stevenson and Jones.

DEFINITIONS OF THE WORDS AND TERMS THAT ARE USED THROUGHOUT THE WORK.

Acromegaly. An affection in which the extremities are abnormally enlarged.

Ageusia. A loss of taste.

Agraphia. Inability to form the letters in writing; due to disease of the motor speech center, whereby the power of writing is abolished, even when the hand center is intact and the movements of the arm are unimpaired. The same may follow an isolating lesion beneath the cortical speech center. Thought, and in some cases speech, may be performed correctly, while the capability of writing is lost.

Akinesia. A loss of voluntary motion.

Alexia. A loss of the power of reading.

Amaurosis. A morbid condition in which there is total blindness, without there being any observable lesion.

Amblyopia. A partial loss or dimness of vision from structural changes accompanying disease of the eye or optic nerve.

Amnesia. A loss of memory.

Amyotrophic. A term which signifies a lack of muscular nutrition.

Analgesia. A loss of sensibility to pain.

Anæsthesia. A loss of tactile sensibility.

Angio-neurosis. A term given to disorders of the vasomotor centers and nerves.

Angio-spasm. A condition in which there is increase of vasomotor tone and spasmodic contraction of the coats of the arteries.

Angio-paralysis. Paralysis of the muscular coats of the arteries, thereby permitting them to become dilated.

Anode. The positive pole of a galvanic battery.

Anosmia. The loss of the sense of smell in one or both nostrils.

Anthropophagy. This term, literally speaking, means cannibalism.

Aphasia. A morbid condition in which the power to speak is lost.

Apoplexy. A comatose condition resulting from pressure on the brain either from turgescence of vessels or from extravasation of blood.

Argyll-Robertson Pupil. A failure of the pupils to react to light, without any perceptible impairment of its normal reaction during the accommodation of vision for near objects.

Astasia. Inability to stand.

Asthenopia. Weakness of sight; a condition in which exertion of the eyes is wearisome and painful.

Astigmatism. An abnormal condition of vision caused by irregularity in the curvature of the cornea or crystalline lens of the eye.

Ataxia. A morbid condition characterized by a loss of the normal power of performing co-ordinated movements, due to loss of the special sensibility of the muscles, articular surfaces, and tendons. This special sense informs the individual of the degree of strength of muscular movements, and by it definite and co-ordinated movements are made possible. The weight of objects and position of the limbs are also determined by it.

Athetosis. This is a name given by Hammond to a peculiar form of movement, characterized by slow, successive flexion, extension, pronation, and supination of the fingers, hand, and arm, or of analagous movements of the toes and feet. The motion rarely ceases in waking hours except for a short time. The contractions are forcible, steady, and even, and sometimes painful. The hand assumes characteristic positions.

Basal Ganglia (Corpus Striatum and Optic Thalamus). Collections of nerve-cells buried within the substance of each cerebral hemisphere near to its base.

Bell's Palsy. Unilateral facial paralysis.

Blind Spot. The point in the retina where the optic nerve enters—about two lines to the nasal side of the macula lutea.

Boulimia. A term applied to an insatiable craving for food. Usually met with in insane persons, and is attributable to a disturbance of the vagus nerve.

Bulbar Symptoms. A train of symptoms referable to the tongue, lips, palate, pharynx, and larynx, caused by a degeneration of those nuclei in the medulla which preside over movements of the respective parts.

Burdach's Column. The postero-external column of the spinal cord.

Catalepsy. A morbid condition in which consciousness and volition are suspended, and the voluntary muscles are in a state of rigidity.

Cataphoresis. By this term is meant that there is a transference of fluids during the flow of the continuous current from the positive to the negative pole.

Cathode. The negative pole of a galvanic battery.

Cauda Equina. The termination of the spinal cord, giving off a large number of nerves, which, when unraveled, resemble a horse's tail.

Cheyne-Stokes Respiration. An abnormal form of respiration in which rhythm undergoes frequent and regular modifications—that is, gradually increasing to a certain maximum, and then gradually decreasing in frequency until they cease, when they begin to increase in frequency and in depth. It is due to pressure on the medulla interfering with the functions of the pneumogastric.

Chiasm. The crossing of the fibers of the optic nerves.

Choked Disk. The condition of the retina observed in connection with neuro-retinitis.

Chorea. An affection characterized by irregular, involuntary clonic contraction of the muscles; one form being known as St. Vitus' dance.

Cincture-feeling. A synonym for the so-called "girdle pain." A sense of painful contraction on some part, more frequently around the waist.

Clark's Column. A column of cells in the spinal gray matter.

Commissural Tracts. Fibers which tend to unite the cells of homologous parts of the cerebral hemispheres.

Coma. A state of drowsiness, produced by compression of the brain and other causes.

Contracture. The term "contracture" is applied to that condition where there is a persistent muscular spasm, fixing a limb or limbs in a certain posture. The muscles become rigid and shortened and this tonic spasm may last for days or months. A contracture may be the result of a functional disorder, as from hysteria, or may be due to organic lesions of the brain or spinal cord.

Convulsions. Consist of abnormal and exaggerated muscular contractions occurring in rapid succession. Convulsions may be clonic—that is, the muscles rapidly and alternately contract and relax in an exaggerated and irregular way; or they may be tonic—that is, contracted steadily and continuously.

Cramp. When a tonic muscular contraction is painful it is called a cramp.

Cretinism. A form of idiocy especially prevalent in the deep valleys of certain mountainous regions of Europe, characterized by goiter, stinted growth, swelled abdomen, wrinkled skin, wan complexion, vacant and stupid countenance, misshapen cranium, and comparative insensibility.

Crossed Paralysis. A condition where right or left hemiplegia coexists with a paralysis of some cranial nerve of the opposed side. It varies in type according to the cranial nerve involved.

Crusta Cruris. The anterior or motor part of the crus cerebri.

Corna Radiata. This term embraces all the fibers that pass from the cerebral cortex toward the region of the crus.

Co-ordination. The working in harmony of muscles in the performance of any function.

Corpus Striatum (Striped Body). One of the basal ganglia situated at the base of the cerebrum.

Cortex. A term that literally signifies "rind" or "external covering." It is applied, therefore, to the gray matter of the convolutions of the cerebrum and cerebellum.

Degeneration. A term applied in pathology to a morbid change in the structure of parts. Degeneration consists of two processes, a wasting of the nerve-structure, cells, and fibers, and an overgrowth of the connective-tissue elements.

Delayed Sensation. A symptom in which an appreciable time exists, usually one or more seconds, between the time of applying a stimulus and its appreciation in consciousness. Normally a tactile sensation can be felt and responded to in less than one-tenth of a second.

Dementia. Loss of reasoning power; want of intellect.

Diplegia. Paralysis of both upper and lower limbs.

Dipsomania. An irresistible desire for stimulants. It may grow out of habit; it may be an inheritance; it may be an insane symptom; or it may be the vestige of an attack of insanity.

Diplopia. Double vision. The individual sees two objects instead of one; may be transient or habitual.

Duchenne's Palsy. Bulbar paralysis, or labio-glosso-laryngeal paralysis.

Dyspnœa. Difficult respiration.

Dysthropy. A term signifying defective nutrition.

Eclampsia. Acute attacks of epileptiform spasms.

Echolalia. The thoughtless repetition of words and phrases spoken by others, the subject (insane) not associating any mental conceptions with them.

Ecstasy. An entranced condition with visions, the body being meanwhile in a cataleptic condition.

Electrodes. The terminal attachments to an electrical instrument, by means of which electrical currents are applied to a patient.

Electrolysis. The decomposition of compound substances by the chemical action of the galvanic current.

Electrometer. An instrument for numerically measuring or comparing the forces due to various charges of electricity.

Electroscope. An instrument which simply indicates the existence of a force due to a charge.

Embolism. Plugging of a blood-vessel by a clot or foreign body which has been transported to the seat of its lodgment by means of the blood current.

Encephalitis. Inflammation of the brain.

Epilepsy. A cerebro-spinal disease in which the patient suddenly falls with loss of consciousness and convulsive movements of the muscles.

Erotomania. A term applied to those cases where there is an intensely morbid desire toward a person of the opposite sex, without reference to the sexual act. A sort of exaggerated and insane state of "being in love."

Exophoria. A tending of the visual lines outward.

Exophthalmus. An abnormal protrusion of the eyeballs.

Faradism. The employment of the interrupted current generated by the magnetizing and demagnetizing of a soft-iron core within a helix.

Fissure. A prominent and distinctive demarcation between component parts of the brain, the spinal cord, etc.

Fissure of Rolando. The fissure which separates the frontal lobe from the parietal lobe of the cerebrum.

Fissure of Sylvius. The fissure separating the parietal from the temporal lobes of the cerebrum.

Foot-clonus. A morbid reflex phenomenon observed at the ankle in connection with certain forms of spinal diseases.

Formication. A feeling "as if ants were creeping over a part." One of the many subjective phenomena caused by organic and functional disease of the nerve-center.

Franklinism. The employment of electricity generated from glass plates by means of friction.

Friedrich's Disease. The so called " hereditary ataxia."

Galvanism. The employment of a current generated by means of a chemical action.

Galvanometer. The instrument for measuring the current-strength of a galvanic battery.

Ganglion. Any isolated collection of nerve-cells.

Girdle-pain. See *Cincture-feeling*.

Glossoplegia. Paralysis of the hypoglossal nerve, causing a loss of control of the tongue.

Grand Mal. " Greater disease ": Applied in epilepsy to the fully developed fit.

Gubler's Line. An imaginary line connecting the points of apparent origin of the trigeminal (the fifth) nerve-roots.

Gyrus. A synonym for " convolution."

Hallucination. An hallucination is the perception of an object as a real presence, without a real presence to justify the perception.

Hematoma Auris (also termed the **Insane Ear**). This consists in the formation of a sanguineous tumor of the external ear; or, in other words, it consists of a hemorrhage into the substance of the aural cartilage proper, and is probably due to a diseased state of this cartilage or its vessels.

Hemianæsthesia. Impairment of tactile sensibility in one lateral half of the body.

Hemianopsia. A deficiency of one-half of the visual field; in other words, a blindness of half of the visual field.

Hemichorea. Convulsive twitching of the right or left half of the body.

Hemiparaplegia. Paralysis of one lower limb, due to a focal lesion of the spinal cord in the dorsal region, which involves only its lateral half.

Hemiplegia. Paralysis affecting one lateral half of the body, right or left.

Hyperæsthesia. An excessive sensibility to touch, contact, and other stimuli.

Hyperalgesia. An excessive sensibility to pain.

Hydrocephalus. A collection of fluid within the brain; dropsy of the head; water on the brain.

Hypertrophy. Overgrowth from superabundant nutrition with deficiency of waste.

Hypergeusia. Abnormal sensitiveness of the taste apparatus.

Hyperosmia. Abnormal acuteness of smell.

Hypnotism. A form of sleep or partial cerebral inhibition produced by the agency of animal magnetism.

Hysteria. A morbid emotional condition reputed to have its seat in the uterus.

Idiosyncrasy. A term used in medicine to denote any peculiar and obviously non-correlated perversion toward certain external influences.

Illusion. An illusion is the perception of an object actually present, but in characters which that object does not really possess.

Incoherence. A want or absence of cohesion or connection of ideas, language, etc.; incongruity, inconsequence, inconstancy of diction.

Inhibition (*inhibeo*, I hold in). The restraining influence of mental states over any reflex or automatic action.

Intellectual Faculties. A term for those faculties which communicate to man and animals knowledge of their own internal sensations, and also of the external world; their object is to know existence and perceive qualities and relations.

Imbecility. A term, strictly speaking, applied to a congenital defect of menta, power, of the same kind as, but to a lesser degree than idiocy. A condition of mental enfeeblement resulting from want of brain development.

Impulse (from *impello*, I push against). An influence acting upon the mind, especially suddenly or involuntarily; a sudden thought, idea, determination, or emotion.

Irritative Lesion. A lesion which is not sufficiently destructive to cause paralysis.

Jumpers. A nervous affection characterized by twitching and involuntary imitation. A sudden and peremptory order compelling response on the part of the patient.

Katatonia. A form of insanity characterized by mania, melancholia, and cataleptic symptoms, manifested in alternation.

Kleptomania. In the strict sense of the term, an irresistible impulse to steal.

Larvated. Hidden or obscure; applied by Falret to a form of epilepsy without *petit mal*, or in which it is very slight.

Lemniscus (a ribbon). A bundle of fibers in the pons and crus cerebri, appearing superficially as a triangular band obliquely around the superior peduncles from the funiculus olivarius to the corpora quadrigemina; probably associated with co-ordination of movement.

Lepto-meningitis. Inflammation of the pia mater.

Leucocythemia. An increase of leucocytes with a decrease of the red corpuscles in the blood.

Locomotor Ataxia. A disease of the spinal cord in which there is loss of power to co-ordinate the limbs properly when in motion. There is also usually a loss of power to appreciate weights or the position of the limbs, due to a loss of the muscular sense.

Lucid Interval. An interval between the paroxysms of insanity, during which the mind appears clear and the patient is apparently capable of conducting himself sanely.

Lunacy (*luna*, the moon). The legal term representing those deviations from a standard of mental soundness, in which the person, property, or the civil rights may be interfered with, when incapacity, violence, or irregularities threaten danger to the lunatic himself or to others.

Mania. That form of insanity which is commonly known as madness.

Mania Errabunda. A term that has been indiscriminately applied to periodical, pubescent, and paretic insanity whenever the tendency to roam about aimlessly has been a marked, however temporary, feature of the insanity.

Masochismus. A sexual perversion in which a member of one sex takes pleasure in being dominated by the other, so that the male, for instance, has sensuous delight in submitting to humiliating and degrading acts from the female.

Massage. Friction and manipulation of the body. From the French word *masser*, to shampoo.

Mastodynia. Neuralgia of the breast. One form of intercostal neuralgia.

Melancholia. Perverted mentality characterized by excessive gloom, distrust, and depression.

Migraine. Hemicrania ; sick-headache.

Monoplegia. Paralysis of some special group of muscles or of one limb.

Muscular Sense. By the term "muscular sense" is meant the power to discriminate between weights or to touch any part of the body with the finger.

Myelitis. Inflammation of the spinal cord.

Myotonia. A morbid affection in which there is painless, tonic contraction of voluntary muscles, lasting several seconds at a time, thus interfering with locomotion and other movements.

Myxœdema. A morbid state characterized by a swelling and distortion of the outlines of the features, from a gelatinous infiltration of the skin, and usually accompanied by dullness of the senses, slow, monotonous speech, and a cretinoid aspect.

Necrophilism. A term used in two senses, either a morbid desire for eating dead bodies, or an insane impulse to violate a corpse. Those so affected are called *necrophiles.*

Narcotic. Certain drugs and poisons which act on the nervous system, and in small doses produce sleep, but in large doses bring on complete insensibility and death.

Necrotic Softening. Death of a part from a sudden arrest of its blood-supply.

Neuralgia. Pain felt over the distribution of a nerve, without fever.

Neurasthenia. Nervous exhaustion or nervous prostration.

Neuritis. Inflammation of a nerve.

Neuroglia. A recticular substance lying between the ganglionic cells and nerve-fibers in the brain and cord.

Neurology. The science of nervous diseases.

Neuroma. A tumor composed of nerve tissue.

Neurosis. Nervous disease with specified lesions ; a morbid nervous state.

Neuropathic Constitution. That state or condition where there is an over-irritable, unstable, inadequately developed, and badly nourished nervous system—one with a tendency to disease.

Nystagmus. A constant involuntary movement of the eyeballs, generally horizontal, but occasionally rotary, and in some rare instances vertical, observed in some forms of disease of the nervous system.

Objective Symptoms. Those symptoms which can be observed and noted by the physician.

Œdema. Transudation of the sero-albuminous elements of the blood, without a rupture of the vessels.

Optic Thalamus. One of the basal ganglia situated at the base of the cerebrum.

• **Pachymeningitis.** Inflammation of the dura mater.

Palmus. See *Jumpers.*

Paranoia. Unsoundness of mind; a condition of mind beyond comprehension.

Paraplegia. The term paraplegia usually refers to paralysis of the lower extremities; it may, however, be applied to paralysis of the upper extremities.

Paresis. Paresis signifies incomplete or partial paralysis.

Paræsthesia. A term applied to all the morbid general sensations except pain. The paræsthesias include such feelings as numbness, prickling, formication, flushing, burning, itching, and various peculiar visceral sensations.

Paralysis. A loss of muscular power due to an interference with the transmission of nerve-force from its site of development in the central nervous system to the termination of the nerve-fibers in the muscles.

Paraphasia. This is a condition where the substitution of wrong words or symbols occurs in conversation or during attempts at writing. The patient is conscious of this error, but is unable to correct it. This condition is due to a lesion of the island of Reil.

Pathological Anatomy. When a tissue or an organ of the body has suffered modifications of substance or of structure in consequence of disease, the study of those material changes, which are the result of disease, constitutes the science of *pathological anatomy.*

Pathology. When the functions of any of the organs of the body are perverted, the study of those changes and perversions of functions constitutes the science of *pathology.* Pathology is used with a meaning totally distinct from that of pathological anatomy.

Peripheral Paralysis. That variety of paralysis in which the interference with the transmission of nerve force is due to some lesion which is operative between the exit of the nerve from the nerve centers and their termination in the muscular fibers.

Petit Mal. "Lesser disease." Applied to the minor attacks of epilepsy.

Poliomyelitis. Inflammation of the gray matter of the anterior horns of the spinal cord. The so-called "infantile spinal paralysis."

Polyæsthesia. When the touch of one point is felt as two or more.

Porencephaly. A defect of structure consisting of abnormal passages in, or absence of any part of the cerebrum.

Process. A prolongation or eminence.

Prosopalgia. Facial neuralgia.

Psychiatry. The science of mental diseases.

Psychosis. A morbid mental state, and is nearly identical with insanity, but has a broader meaning.

Ptosis. Inability to raise the upper eyelids.

Puncta Dolorosa. Points of tenderness clinically observed along the course of nerve-trunks affected with neuralgia.

Pyramidal Tracts. Fibers which are so called because they pass through and compose the anterior pyramids of the medulla oblongata. They are the motor fibers leading from the brain to the periphery.

Ramollisment. A localized necrosis or softening of the brain substance.

Reaction of Degeneration. Abnormal electrical formula of the so-called "muscular reactions to galvanic currents." This is also associated with an impairment or a total loss of faradic excitability of nerve and muscle.

Reflex Action. The term reflex may be properly applied to any generation of nerve-force which occurs as a consequence of an impression that is received by a nerve-center—that is, a sensory impression transformed into a motor impulse.

Rheophores. The cords of an electrical battery which are employed to connect the poles with its electrodes during an electrical application.

Sadismus. A sexual perversion in which a member of one sex takes sexual delight in exercising force upon the other sex.

Sclerosis. A morbid condition dependent upon an increase in the connective-tissue elements of an organ or other structure.

Somnambulism. Sleep-walking.

Spinal Meningitis. A term applied to the inflammation of the meninges or membranes which inclose the spinal cord.

Spinal Segment. A disk of the cord, with a pair of spinal nerves attached to it.

Spastic. Relation to contraction. The term spastic paraplegia has reference to a type of paraplegia associated with a peculiar rigidity of the muscles and exaggeration of the spinal reflexes.

Status Epilepticus. A state characterized by continued epileptic convulsions with scarcely perceptible intermissions.

Static Electric Bath. Where the patient is placed upon an insulated platform and then positively or negatively charged from the electro-static machine.

Strabismus. A condition of abnormal deviation of the visual axes, resulting in habitual diplopia, of which the patient may often be unconscious; cross-eyed.

Subjective Symptoms. Those symptoms which are felt by the patient and give no outward sign.

Sulcus. A line of demarcation between convolutions of the cerebral cortex.

Syringo-myelitis. The formation of a fissure or cavity in the spinal cord.

Symptom. We include under the term "symptom" every phenomenon presented by the patient which is a deviation from, or an addition to, his condition when in average health. We can know nothing of any disease except by the presence of symptoms, either objective or subjective.

Tache Cérébrale. A phenomenon formerly supposed to be a pathognomonic sign of meningitis, but now known to occur in many diseases. It consists in the production of a bright red line by drawing the finger-nail over the skin of the patient, this line lasting longer, appearing earlier, and being broader and deeper-colored than would be the case in a healthy person.

Tachycardia. A morbid condition in which there is a rapid or forceful beating of the heart which is subjectively recognizable and is not due to organic heart disease.

Tabes (a wasting away). The term *tabes dorsalis* signifies a wasting away of the posterior part of the spinal cord and is the synonym for *locomotor ataxia* and *posterior spinal sclerosis.*

Tegmentum Cruris. The posterior or sensory part of the crus cerebri.

Tetanus. A disease characterized by rigidity, with paroxysms of tonic convulsions; a synonym for lock-jaw.

Tetanus Neonatorum. Infantile tetanus.

Thomson's Disease. See *Myotonia.*

Thrombosis. Occlusion of a blood-vessel by a coagulum formed at the seat of occlusion.

Tic Convulsif. Spasmodic twitching of groups of muscles, especially of the facial muscles.

Tic Douloureux. A severe form of facial neuralgia.

Tinnitus Aurium. The humming or other noises heard in the ear and not due to external sounds. It gives rise to illusions of hearing in the insane.

Titubation (*titubo*, I stagger). A staggering gait, sometimes dependent on disease of the nervous system.

Transferred or **Referred** or **Reflex Sensations.** Those symptoms in which the irritation is made at one point and felt at another. The whole class of so called reflex pains are really transferred sensations, since in reality there is no reflex action in the process.

Tremor. Tremor may be defined as a fine or coarse clonic spasm of regular or irregular distribution and of limited range, occurring either as the physiological expression of certain nerve states, or as a symptom of certain pathological conditions.

Trophic. Relating to nutrition.

Türck's Column. The direct pyramidal column of the spinal cord.

Vertigo. Dizziness.

Word-blindness. The state of the mind of the patient to whom the sight of the word, previously understood, conveys no idea of its meaning. The patient may at the same time perfectly understand the spoken word. This disorder is almost always due to some organic cerebral lesion.

Word-deafness. The state of a patient to whom the sound of a word, previously understood, conveys no idea of its meaning. The sight of it may still convey the idea, and the rest of the patient's mental power may be perfectly sound. The cause of this disorder is usually an organic cerebral lesion.

Wrist-Drop. Paralysis of the extensor muscles of the hands from pressure or injury to the musculo-spiral nerve, or from lead poisoning, in consequence of which the hand and wrist cannot be supported: whence the name.

Wry Neck (Torticollis). An involuntary fixed inclination of the head toward one of the shoulders.

Zelotypia (from ζῆλος, 'love,' and τύπος, 'model'). It has been proposed to apply this name to the violent mental affection produced by the acknowledged or presumed infidelity of a beloved object, and to the consequences of such affection.

Zoanthropia. A species of monomania, in which the patient believes himself transformed into an animal.

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